– Draft –

Environmental Assessment for the Orbital/Sub-Orbital Program

Prepared for:

Detachment 12/RP
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14. ABSTRACT
This Environmental Assessment documents the environmental analysis of implementing the Orbital/Sub-Orbital Program (OSP), which would provide enhanced capability and flexibility to the development of space launch and target vehicles using excess Minuteman II and Peacekeeper rocket motors (including use of commercial upper stages) to meet a wide variety of mission requirements. It is expected that all OSP launches would be conducted from an existing Government range and/or commercial spaceport located at Vandenberg Air Force Base, CA; Kodiak Launch Complex, AK; Cape Canaveral Air Force Station, FL; and Wallops Flight Facility, VA.

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FINDING OF NO SIGNIFICANT IMPACT (FONSI)

ENVIRONMENTAL ASSESSMENT FOR THE ORBITAL/SUB-ORBITAL PROGRAM

Agency: United States Air Force (USAF)

Background: Pursuant to the provisions of the National Environmental Policy Act (NEPA) of 1969, Executive Order 12114, Council on Environmental Quality (CEQ) Regulations [40 Code of Federal Regulations (CFR) Parts 1500-1508], and 32 CFR Part 989, the USAF has conducted an assessment of the potential environmental consequences of implementing the proposed Orbital/Sub-Orbital Program (OSP). The assessment focused on those activities that have the potential to affect the human and natural environments.

Advances in satellite manufacturing technology have allowed the size and mass of satellites to diminish without loss of capability. As a result, the desire for reliable, low-cost spacelift systems, particularly for small and micro Research, Development, Test and Evaluation (RDT&E) satellites, has increased in recent years. However, finding shared space on some commercial or larger launch vehicles for specific orbits is not always possible or cost effective.

The Department of Defense (DOD) has a long history of using small satellites to support the testing of new components prior to incorporation into large-scale operational satellite programs. In addition, a number of small and micro RDT&E satellite programs within other US Government agencies could be supported. Low-cost target vehicles are also needed to provide realistic threat simulations for the testing of long-range ballistic missile defense systems by the DOD. Other Government missions may potentially require short-duration, sub-orbital flights for experimental purposes.

Under the OSP, the USAF is developing a new family of launch vehicles using surplus Minuteman (MM) II and Peacekeeper (PK) Inter-Continental Ballistic Missile (ICBM) rocket motors (along with commercial upper stages) to support both orbital launches of small and micro satellites, and sub-orbital-trajectory missions. The OSP will provide low-cost, reliable launch services for Government-sponsored payloads using flight-proven hardware and software currently available, with a demonstrated success record.

Consistent with the National Space Transportation Policy of 1994, OSP launches will support only US Government payloads, or those missions sponsored through US Government agencies. In addition, the US Secretary of Defense must approve each mission to ensure that program launches do not compete with, and are not detrimental to, the commercial space launch industry.

To avoid the cost of building and maintaining new launch complexes, the OSP will maximize the use of existing facilities for launch support. To satisfy various orbital inclination requirements, launch schedules, and other mission needs, spaceport locations on both East and West Coasts of the United States will be utilized.

The Environmental Assessment (EA) considers all potential impacts of the Proposed Action and the No Action Alternative. This Finding of No Significant Impact (FONSI) summarizes the results of the evaluations of the proposed activities associated with the proposed OSP.

Proposed Action and No Action Alternative: The EA documents the environmental analysis of implementing the OSP, which will provide enhanced capability and flexibility to the development of space launch and target vehicles using excess MM and PK rocket motors (including use of commercial upper stages and various subsystems) to meet a wide variety of mission requirements. It is expected that all launches will be conducted from an existing Government range and/or commercial spaceport located at Vandenberg Air Force Base (AFB), California; Kodiak Launch Complex, Alaska; Cape Canaveral Air Force Station (AFS), Florida; and Wallops Flight Facility, Virginia.

Because only a few specific missions have been identified to date for the OSP, the EA takes a programmatic approach in assuming a maximum of five or six launches per year, over a 10-year period, beginning in 2005. All five or six annual launches could occur from just one of the four ranges, or be spread across the different ranges. Vandenberg AFB and Kodiak Launch Complex will be capable of handling up to six launches per year, while Cape Canaveral AFS and Wallops Flight Facility can support up to five launches per year. For each range, applicable site modifications and construction activities (including some demolitions), rocket motor transportation, pre-flight preparations, flight activities, and post-launch operations are addressed. At each launch site, existing facilities will be used, with limited facility modifications required in most cases. Both preferred and alternate launch support facilities (if available) are considered.

In terms of orbital missions, a wide variety of small- and micro-satellites could be launched from any of the launch sites into Low Earth Orbit (LEO). Specific orbital missions identified to date for the OSP, and other representative spacecraft, are also analyzed in the EA.

Per the CEQ and USAF regulations, this EA also analyzes the No Action Alternative, which serves as the baseline from which to compare the Proposed Action. Under the No Action Alternative, the OSP would not be implemented. However, some existing missions involving the use of excess ICBM assets for target launches out of Vandenberg AFB and Kodiak Launch Complex would still be conducted, in accordance with prior NEPA analyses. In addition, use of ICBM assets for orbital launch purposes would still be considered on a case-by-case basis, following appropriate NEPA reviews.

Environmental Effects: For each of the four ranges proposed for conducting OSP launches, potential environmental effects were assessed for the following environmental resources: air quality, noise, biological resources, cultural resources (Vandenberg AFB only), health and safety, and hazardous materials and waste management. Other resource areas—including hydrology and groundwater, utilities, land use, transportation, socioeconomics, environmental justice, soil resources, visual and aesthetic resources, and cultural resources (at all other sites)—were not analyzed further because no significant impacts to these resources are anticipated as a result of implementing the Proposed Action. Potential effects on the environment from implementation of the Proposed Action are described in the following paragraphs.

- ***Air Quality.*** Because limited modifications are required at most of the ranges and facilities, construction-related impacts on air quality will be minimal. At Vandenberg AFB, proposed demolition and construction activities at some of the launch sites will generate fugitive dust from structure removal, ground disturbance, and related operations. However, no significant amounts of emissions are anticipated, and standard dust reduction measures will be implemented.

  During OSP launches at each of the four ranges, rocket motor exhaust emissions will be released into the lower atmosphere. Because the launches are infrequent, short-term events, emissions products will be rapidly diluted and dispersed by prevailing winds. No violation of air quality standards or health-based standards for non-criteria pollutants is anticipated. Also, the USAF's review of the General Conformity Rule resulted in a finding of presumed conformity with the State Implementation Plan for Vandenberg AFB. No Conformity Determination is required for the other three ranges. Overall, no significant impacts to air quality are anticipated to occur.

- ***Noise.*** Noise exposures from proposed demolition, modification, and construction activities at Vandenberg AFB are expected to be minimal, short term, and generally affecting only the areas immediately around each facility. If blasting of concrete and steel structures becomes necessary during the demolition work, much higher impulse noise levels will also be generated, but such occurrences will be rare. Any construction-related noise at the other three ranges will be minimal.

  OSP launches at each of the four ranges will generate an A-weighted Sound Exposure Level (ASEL) exceeding 120 decibels (dB) in the immediate vicinity of each launch site, to about 85 dB ASEL nearly 8 miles (13 kilometers) away. Outside range boundaries, local communities could experience launch noise levels up to 100 dB ASEL at some locations. While these noise exposure levels can be characterized as very loud, they will occur infrequently, are very short in duration (about 20 seconds of intense sound per launch), and, for public areas, will be well within Occupational Safety and Heath Administration standards. As a result, no significant impacts to the noise environment on and around each range are expected.

  Sonic booms generated during the launch vehicle's ascent are not expected to affect mainland coastal land areas at any range. However, launches from the Space Systems International (SSI) Commercial Launch Facility (CLF) or from other south Vandenberg AFB space launch complexes (SLC) could generate sonic booms over the northern Channel Islands, depending on the launch trajectory used. Resulting overpressures from SSI CLF launches could reach up to 1 pound per square foot (psf) on the islands. For launches from the SLC-4 sites, overpressures will be higher, estimated to be between 1 and 7 psf. The sonic booms will typically be audible for only a few milliseconds, and launches over the islands are expected to occur infrequently.

- ***Biological Resources.*** Because limited modifications are required at most of the ranges and facilities, construction-related impacts on biological resources will be minimal. At Vandenberg AFB, where more extensive modifications are to occur, demolition and construction-related activities will generate short periods of relatively continuous noise. In rare instances, blasting of existing structures may occur, producing very brief but high-impulse noises. Noise exposures, however, will be short-term and localized. Vegetation overgrowth around some unused launch sites at the base will require clearing, and some grading and excavation will occur, mostly in pre-disturbed areas. However, limited areas will be disturbed, and vegetated areas will be surveyed for protected and other sensitive species prior to project implementation. Some of the buildings and structures proposed for demolition and/or modification are currently used as nesting and roosting sites for various bird species, including some protected under the Migratory Bird Treaty Act. A few bat species have also been found to roost in some of the buildings. To avoid impacts to these species, surveys will be conducted several months prior to project implementation, before the start of the nesting season. Methods to discourage roosting and the initiation of nests will be implemented prior to demolition and facility modifications.

  Exposure to short-term noise from launches, from helicopter overflights at some of the ranges, and from sonic booms over the northern Channel Islands of California (for Vandenberg AFB only) could cause startle effects in protected bird species, in pinnipeds (for the West Coast sites only), and in other wildlife. However, on the basis of prior monitoring studies conducted by biologists at the four ranges, it has been determined that rocket launch activities have a negligible, short-term impact on marine mammals, most sea and shore birds, and other protected species.

  The exception in this case has been the Federally endangered California least tern, which nests and forages along the beaches and coastal dunes at Vandenberg AFB. During some prior Delta II launches at the base, a few pairs of least terns abandoned their nests. However, OSP launches will differ from the Delta II launches in that (1) the OSP launch sites are located much further away from least tern nesting habitat, (2) there will be no OSP launch vehicle overflights of the main least tern colony, (3) the proposed OSP launch vehicles will generate slightly lower noise levels and for a shorter duration, and (4) no more than two OSP launches per year will occur from those launch sites closest to nesting areas. To minimize the potential for impacts on least terns at Vandenberg AFB, the OSP will avoid night and low-light launches, to the extent possible, from the closest launch sites.

Launch emissions have the potential to acidify nearby streams, marshes, and other wetland areas at all four of the ranges. However, surface water monitoring following launches has not shown acidification to occur. In addition, acid-neutralizing minerals in the soil and/or the constant deposition of ocean salt spray will reduce the potential for acidification of surface waters. Some temporary distress to vegetation near launch sites from launch emissions can be expected, but no long-term adverse effects will occur.

The probability for an aborted launch to occur is extremely low. If an early abort were to occur, actions will immediately be taken for the recovery and cleanup of unburned liquid or solid propellants, and any other hazardous materials that had fallen on beaches or in shallow waters. Any propellants remaining in offshore waters will be subject to constant wave action and currents. Thus, water circulation will, in particular, help to prevent localized build-up of perchlorate concentrations from solid propellants, which has proven to be a slow process. As a result, no significant impacts on biological resources are expected to occur.

Through coordination and consultations with the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service, each of the four ranges has implemented various plans and measures to limit the extent and frequency of potential impacts from rocket launches, and in some cases helicopter overflights, on protected and sensitive species. In addition, monitoring of certain species is conducted on a regular basis to ensure that no long-term impacts occur.

As a result, no significant impacts on biological resources are anticipated, and no long-term adverse effects on threatened and endangered species or critical habitats are expected to occur.

- ***Cultural Resources.*** Of the four ranges evaluated, only Vandenberg AFB has the potential for impacts to cultural resources. On base, several known archaeological sites are in proximity to some of the facilities proposed for demolition, modification, and construction. However, these activities will be tailored to ensure archaeological resources are avoided. Should ground disturbance activities occur near resource sites, precautionary measures (e.g., boundary testing, on-site monitoring, and fencing around resource sites) will be implemented. Base personnel and contractors will also be informed of the sensitivity of such sites. To reduce the potential for impacts, excavation and trenching operations will be limited to previously disturbed areas as much as possible.

  Four facilities proposed for OSP use have been determined to be eligible for listing on the National Register of Historic Places for their Cold War, ICBM Program historic context. Modifications are proposed for only one of the buildings; however, a Historic American Engineering Record of the building has already been completed. In addition, the types of activities proposed to occur in these buildings will be similar to that of the earlier MM and PK ICBM support programs.

  No impacts to archaeological sites or historic buildings are expected from nominal flight activities. However, falling debris from a flight termination or other launch anomaly could strike surface or subsurface archaeological deposits, or other cultural resources. With the potential for fires to occur, firefighting activities can also damage subsurface historic and prehistoric archaeological sites. In the unlikely event that a mishap occurs, post-mishap recommendations will include post-event surveying, mapping, photography, and site recordation to determine and record the extent of the damage. These efforts will be coordinated with applicable range representatives and the California State Historic Preservation Officer.

As a result, no significant impacts to cultural resources at Vandenberg AFB are expected.

- ***Health and Safety.*** At the four ranges, all OSP activities will be accomplished in accordance with applicable Federal, state, and local health and safety standards, as well as all appropriate DOD and Agency-specific regulations. Regarding rocket motor transportation over public roads, accident rates for ongoing operations have historically been very low. To conduct OSP launches at any of the ranges, range safety officials will evacuate the launch hazard area and issue Notices to Airmen, as well as to Mariners, and the hazard areas will be determined clear of both aircraft and surface vessels before proceeding with the launch. For debris generated during each OSP launch (from liftoff through to orbit insertion), expected casualty risks for individuals on the ground will be no greater than 1 in 1,000,000, in accordance with range safety standards. By adhering to established safety standards and procedures, the level of risk to range personnel, contractors, and the general public will be minimal at all of the locations affected. Thus, no significant impacts to either occupational or public health and safety are expected to occur.

- ***Hazardous Materials and Waste Management.*** At Vandenberg AFB and Cape Canaveral AFS, some of the proposed building modifications, and related demolitions, might require surveys for asbestos, lead-based paint, and PCBs if such information is not already available. Any removal of hazardous materials from the buildings and facilities will require containerizing and proper disposal at permitted facilities.

  At Vandenberg AFB, the cumulative generation of solid waste from OSP-related demolition and construction activities, in addition to other planned demolitions, has the potential to exceed the permitted disposal tonnage on base. Coordination of implementation schedules for these projects, and appropriate tracking of disposal tonnages, will be needed to ensure that permitted disposal amounts at the Base Landfill are not exceeded.

  At all four ranges, hazardous materials will be managed in accordance with well-established policies and procedures. Hazardous wastes will be properly disposed of, in accordance with all applicable Federal, state, local, and Agency-specific regulations. Each range has in place a plan that provides guidelines and instructions to prevent and control accidental spills of hazardous materials. Appropriate permits are also in place and workers are trained. Hazardous material and waste-handling capacities will not be exceeded, and management programs will not have to change.

  Consequently, no adverse impacts from the management of hazardous materials and waste for the OSP are expected.

Because of the potential global effects of launching rockets over the oceans and through the Earth's atmosphere to orbit, the EA also considered the environmental effects on the global environment in accordance with the requirements of Executive Order 12114. Specifically, potential impacts on the upper atmosphere and stratospheric ozone layer, on marine life in the Broad Ocean Area, and on safety-related issues associated with orbital and re-entry debris were considered. These are described in the following paragraphs:

- ***Upper Atmosphere/Stratospheric Ozone Layer.*** The exhaust emissions released from OSP launch vehicles into the upper atmosphere will add to the overall global loading of chlorine and other gases that contribute to long-term ozone depletion. However, when compared to the amount of emissions released on a global scale, the flight tests will not be statistically significant in contributing to cumulative impacts on the stratospheric ozone layer. Emissions will be rapidly dispersed during the launch vehicle's ascent. Thus, no mitigating actions will be necessary.

- ***Broad Ocean Area/Marine Life.*** Sonic boom overpressures from launch vehicles could be audible to protected marine species and sea turtles underwater. An underwater acoustic pulse of 178 dB [referenced to 1 micro Pascal (µPa)] is considered the lower limit for inducing behavioral reactions in marine mammals (cetaceans), while 218 dB (referenced to 1 µPa) is considered the lower limit for inducing temporary threshold shift (TTS) in marine mammals and sea turtles. However, the resulting underwater pressures from sonic booms generated by OSP launch vehicles and sub-orbital target payloads will fall below the lower limits for inducing behavioral reactions, and well below the TTS threshold.

  For marine animals, the potential exists for direct contact or exposure to underwater shock/sound waves from the splashdown of spent rocket motors and sub-orbital target payloads. However, the likelihood for protected marine mammals or sea turtles to be located in close proximity to the impact points is extremely low, as OSP launches will occur only a few times per year, and impacts from each flight likely will not occur at the same locations.

  Though residual amounts of battery electrolytes, hydraulic fluid, and propellant materials in the spent rocket motors could lead to the contamination of seawater, the risk of marine life coming in contact with, or ingesting, toxic levels of solutions is unlikely, considering the rapid dilution of any contaminants and the rapid sinking of any contaminated components to the ocean floor.

  In summary, OSP launches will have no discernible effect on the ocean's overall physical and chemical properties. There will be minimal risk of launch vehicle components hitting or otherwise harassing marine mammals and sea turtles within the open ocean. Moreover, such activities will have no discernible effect on the biological diversity of either the pelagic or benthic marine environment. Consequently, no threatened and endangered marine mammals or sea turtles are likely to be adversely affected, nor will other biological resources within the open ocean be significantly impacted.

- ***Orbital and Re-entry Debris.*** The probability that OSP mission spacecraft in LEO will collide with medium- and large-size debris over their functional lifetimes is considered low. Moreover, OSP missions will be conducted and timed to avoid any possible impact or collision with the International Space Station and other manned missions, as part of normal operations. Accordingly, no significant impacts to the orbital debris population are expected.

  For OSP mission debris that survives atmospheric re-entry, expected casualty risks on the ground for all upper stage motors, and for all or most OSP orbital mission payloads (spacecraft), will be within DOD guidelines (expected casualty risk levels no greater than 1 in 10,000). Because of this, and the fact that no casualties from re-entry debris have been reported over the last 40 years, no significant impacts from re-entry debris are expected to occur.

Environmental Monitoring and Management Actions: Within the EA, various management controls and engineering systems for all locations affected are described. Required by Federal, state, DOD, and Agency-specific environmental and safety regulations, these measures are implemented through normal operating procedures.

Though no significant or other major impacts are expected to result from implementation of the Proposed Action, some specific environmental monitoring and management activities have been identified to minimize the level of impacts that might occur at some locations or in some environmental settings. They include avoidance of launches (whenever possible) to prevent noise impacts on pinnipeds during the pupping season, light management plans to minimize impacts on nesting sea turtles and hatchlings, and spacecraft design considerations to minimize orbital and re-entry debris. These and other measures to be implemented are summarized in Section 4.4 of the EA.

Public Review and Comment: An availability notice for public review was published in local newspapers for each program support location on or before November 3, 2005, initiating a 30-day review period that ends on December 2, 2005. Copies of the Draft EA and Draft FONSI were made available in local libraries in Alaska, California, Florida, Maryland, and Virginia. The EA and FONSI also appeared on the Space and Missile Systems Center (SMC), Los Angeles AFB web site at http://ax.losangeles.af.mil/axf, listed under "announcements."

Point of Contact: The point of contact for questions, issues, and information relevant to the EA for the OSP is Mr. Thomas Huynh, SMC/AXFV, Los Angeles AFB, California. Mr. Huynh can be reached by calling (310) 363-1541, by facsimile at (310) 363-1503, or by e-mail at Thomas.Huynh@losangeles.af.mil.

Conclusion: Based upon review of the facts and analyses contained in the EA, the SMC Environmental Protection Committee, chaired by Brigadier General William N. McCasland, has concluded that implementation of the Proposed Action will not have a significant environmental impact on the human and natural environment, either by itself or cumulatively with other projects. Accordingly, the requirements of NEPA, the CEQ Regulations, and 32 CFR Part 989 are fulfilled and an Environmental Impact Statement is not required.

Approved:

WILLIAM N. MCCASLAND
Brigadier General, USAF
Vice Commander

Date

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ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
AADC	Alaska Aerospace Development Corporation
ABRES-A	Antiballistic (Missile) Reentry System-A
ABRES-B	Antiballistic (Missile) Reentry System-B
AFB	Air Force Base
AFI	Air Force Instruction
AFOSH	Air Force Occupational Safety and Health
AFPD	Air Force Policy Directive
AFRL	Air Force Research Laboratory
AFS	Air Force Station
AFSPC	Air Force Space Command
AFSPCMAN	Air Force Space Command Manual
AK	Alaska
Al_2O_3	Aluminum Oxide
ANSI	American National Standards Institute
ASEL	A-weighted Sound Exposure Level
AST	Office of Commercial Space Transportation
ATDC	Advanced Technology Development Center
BOA	Broad Ocean Area
CA	California
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CARB	California Air Resources Board
CCEMP	Consolidated Comprehensive Emergency Management Plan
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	Chlorofluorocarbon
CFR	Code of Federal Regulations
CLF	Commercial Launch Facility
cm	Centimeter
CNEL	Community Noise Equivalent Level
CO	Carbon Monoxide
COSMIC	Constellation Observing System for Meteorology, Ionosphere, and Climate
dB	Decibels
dBA	A-weighted Decibels
DCE	Dichloroethylene
DEP	Department of Environmental Protection
DEQ	Department of Environmental Quality
Det	Detachment
DNR	Department of Natural Resources
DOD	Department of Defense
DOT	Department of Transportation
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ETR	Extended Test Range
EWR	Eastern and Western Range
FAA	Federal Aviation Administration
FAC	Florida Administrative Code
FDE	Force Development Evaluation
ft	Feet
FL	Florida
FMP	Fishery Management Plan
FONSI	Finding of No Significant Impact
FY	Fiscal Year
gal	Gallon
GHz	Gigahertz
GMD	Ground-Based Midcourse Defense
GPS	Global Positioning System
GVW	Gross Vehicle Weight
HAER	Historic American Engineering Record
HAPS	Hydrazine Auxiliary Propulsion System
HCl	Hydrogen Chloride
Hz	Hertz
ICBM	Inter-Continental Ballistic Missile
ICP	Integrated Contingency Plan
IEEE	Institute of Electrical and Electronic Engineers
in	inch
IPF	Integrated Processing Facility
IRF	Integration Refurbishment Facility
IRP	Installation Restoration Program
JAWSAT	Joint Air Force Academy Weber State University Satellite
kg	Kilogram
kHz	Kilohertz
KLC	Kodiak Launch Complex
km	Kilometer
kph	Kilometers per Hour
KSC	Kennedy Space Center
L	Liter
lb	Pounds

LC	Launch Complex
LEO	Low Earth Orbit
LF	Launch Facility
LHA	Launch Hazard Area
LIDAR	Laser Radar Sensor
LMP	Light Management Plan
LOA	Letter of Authorization
LUCIP	Land Use Control Implementation Plan
m	Meter
MAB	Missile Assembly Building
MARS	Mid-Atlantic Regional Spaceport
MDA	Missile Defense Agency
mi	Mile
MM	Minuteman
MMH	Monomethyl-Hydrazine
MMPA	Marine Mammal Protection Act
MPF	Missile Processing Facility
mph	Miles per Hour
MSDS	Material Safety Data Sheet
MSS	Mobile Service Structure
MT	Missile Transporter
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NFIRE	Near Field Infrared Experiment
NiH_2	Nickel Hydrogen
nmi	Nautical Mile
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NOTU	Naval Ordnance Test Unit
NO_X	Nitrogen Oxides
NRHP	National Register of Historic Places
NSS	NASA Safety Standard
NTO	Nitrogen Tetroxide
OSHA	Occupational Safety and Health Administration
OSP	Orbital/Sub-Orbital Program
PCB	Polychlorinated biphenyl
PK	Peacekeeper
$PM_{2.5}$	Particulate Matter Less Than or Equal to 2.5 Micrometers
PM_{10}	Particulate Matter Less Than or Equal to 10 Micrometers
PMFC	Pacific Marine Fishery Council
PMRF	Pacific Missile Range Facility
PPF	Payload Processing Facility
ppm	Parts per Million
psf	Pounds per Square Foot
psi	Pounds per Square Inch
PTS	Permanent Threshold Shift
QRLV	Quick Reaction Launch Vehicle
RCC	Range Commanders Council
RCRA	Resources Conservation and Recovery Act
RDT&E	Research, Development, Test and Evaluation
ROI	Region of Influence
RSLP	Rocket System Launch Program
RSM	Range Safety Manual
RSO	Range Safety Officer
RV	Reentry Vehicle
SBCAPCD	Santa Barbara County Air Pollution Control District
SBSS	Space-Based Space Surveillance
SEL	Sound Exposure Level
SHPO	State Historic Preservation Officer
SLC	Space Launch Complex
SMC	Space and Missile Systems Center
SO_2	Sulfur Dioxide
SPCC	Spill Prevention, Control, and Countermeasures
SC	Species of Concern
SSI	Spaceport Systems International
START	Strategic Arms Reduction Treaty
SW	Space Wing
SWI	Space Wing Instruction
TCE	Trichloroethylene
TE	Transporter-Erector
THC	Toxic Hazard Corridor
TP	Test Pad
TTS	Temporary Threshold Shift
TVC	Thrust Vector Control
USAF	United States Air Force
USASMDC	US Army Space and Missile Defense Command
USC	United States Code
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
VA	Virginia
VAC	Virginia Administrative Code
VAFB	Vandenberg Air Force Base
VOC	Volatile Organic Compound
WPRFMC	Western Pacific Regional Fishery Management Council
$\mu g/m^3$	Micrograms per Cubic Meter
μPa	Micro Pascal
$\mu Pa^2 s$	Micro Pascal-Squared·Seconds

1.0 PURPOSE OF AND NEED FOR ACTION

1.1 INTRODUCTION

The Space and Missile Systems Center (SMC), Detachment (Det) 12/RP (SMC/Det 12/RP)—also known as Rocket System Launch Program (RSLP)—proposes to use excess Inter-Continental Ballistic Missile (ICBM) rocket motors, including Minuteman (MM) II and Peacekeeper (PK) motors, to provide sub-orbital and space launch (orbital) vehicles to support US Government agencies. The Orbital/Sub-Orbital Program (OSP) would support the increasing number of small satellite programs within the Department of Defense (DOD) and other US Government agencies needing reliable, low-cost spacelift systems. The program would also provide low cost sub-orbital (target) vehicles to support DOD testing of long-range ballistic missile defense systems. RSLP anticipates that all launches would be from Vandenberg Air Force Base (AFB), California (CA); Kodiak Launch Complex, Kodiak, Alaska (AK); Cape Canaveral Air Force Station (AFS), Florida (FL); and Wallops Flight Facility, Virginia (VA). This Environmental Assessment (EA) documents the results of a study of the potential environmental impacts resulting from implementation of the US Air Force's (USAF's) proposed OSP.

> **The Purpose of an Environmental Assessment**
>
> An Environmental Assessment (EA) is prepared by a Federal agency to determine if an action it is proposing would significantly affect any portion of the environment.
>
> The intent of an EA is to provide project planners and Federal decision-makers with relevant information on the impacts that a proposed action might have on the human and natural environments.
>
> If the study finds no significant impacts, then the agency can record the results of that study in an EA document, and publish a Finding of No Significant Impact (FONSI). The agency can then proceed with the action. However, if the results of the EA indicate that there would be potentially significant impacts associated with the action, then the agency must proceed as follows:
>
> - The executing agency must modify the action to reduce the environmental impact(s) to less-than-significant levels; or
>
> - If the action cannot be feasibly mitigated to a level of no significant impact, the executing agency must then prepare and publish a detailed Environmental Impact Statement (EIS) to analyze the impacts in greater depth for the decision-makers' consideration.

In support of the SMC/Det 12/RP, the SMC Environmental Management Branch of Acquisition Civil and Environmental Engineering determined that an EA was required to assess the potential environmental impacts from the pre-flight preparations, flight activities, and post-launch operations associated with the OSP. This EA was prepared in accordance with the National Environmental Policy Act (NEPA, 1969), Executive Order 12114 (Environmental Effects Abroad of Major Federal Actions) (Office of the President, 1979), the President's Council on Environmental Quality (CEQ) Regulations [40 Code of Federal Regulations (CFR) Parts 1500-1508] (CEQ, 2002), and 32 CFR Part 989 (*Environmental Impact Analysis Process*) (USAF, 2001a).

1.2 BACKGROUND

Established by the Secretary of Defense in 1972, the RSLP is tasked to provide Research, Development, Test and Evaluation (RDT&E) launch vehicle support to the DOD and other Government agencies using excess ICBM assets, including MM II and PK assets. Its mission includes planning; payload integration;

launch services and support; booster storage, refurbishment, transportation, and handling; and maintenance and logistics support for selected DOD RDT&E launches. Costs directly attributed to a specific launch, or program, are paid for by the user [e.g., Air Force, Army, Navy, Missile Defense Agency (MDA), National Aeronautics and Space Administration (NASA), and National Oceanic and Atmospheric Administration (NOAA)].

The USAF has developed and fielded several generations of ICBMs in support of national defense. As these systems aged, they were retired and replaced with newer systems. These ICBM components were stored for future use or disposal. Over the years, these assets have been used to support a variety of DOD programs. The smaller tactical rocket motors have been used to test missile guidance systems, to drive rocket sleds to test aircrew egress systems, and to conduct scientific research in human factors engineering or in other areas of scientific investigation. The larger ICBM-class motors have been integrated with other motors to make small sub-orbital rockets used for RDT&E activities or target vehicle systems. (Buckley et al., 1998)

Currently, the USAF has retired all MM I and II solid rocket ICBM systems, and is in the process of deactivating the fielded PK ICBM system, which will be completed in 2005. Retired missiles are dismantled and transported to Government depots for storage under controlled conditions. Several hundred motor sets are available to support DOD launch vehicle initiatives. These components are controlled and maintained by the RSLP, which has used MM assets over the last 30 years to support DOD research and testing. The USAF now has the goal of using these components to support orbital launches as well.

The US Government wants to continue fostering new commercial spacelift initiatives, and so space launch activities using surplus ICBM components would be tracked to ensure that they comply with the Commercial Space Act and do not adversely affect commercial space activities. In addition, upper stages of the OSP launch vehicles would include use of commercial products (e.g., third and/or fourth stage solid-propellant rocket motors, payload fairings, and various subsystems) manufactured by a variety of aerospace contractors. The manufacturing of these components for OSP applications would strengthen the commercial space business base. (Buckley et al., 1998)

1.3 PURPOSE OF THE PROPOSED ACTION

Under the OSP, the USAF is developing a new family of launch vehicles using surplus MM II and PK rocket motors (including commercial upper stages) to support both orbital launches of small and micro satellites, and sub-orbital-trajectory missions.[1] The OSP would provide low-cost, reliable launch services for Government-sponsored payloads using flight-proven hardware and software currently available, with a demonstrated success record.

Consistent with the National Space Transportation Policy of 1994, OSP launches would support only US Government payloads, or those missions sponsored through US Government agencies. In addition, the US Secretary of Defense must approve each mission to ensure that program launches do not compete with, and are not detrimental to, the commercial space launch industry.

To avoid the cost of building and maintaining new launch complexes, the OSP would maximize the use of existing facilities for launch support. To satisfy various orbital inclination requirements, launch

[1] An "orbital" mission is one in which the spacecraft reaches sufficient velocity to maintain a continuous orbit, in this case above the Earth. For a "sub-orbital" mission, the vehicle may briefly reach space altitudes, but rapidly returns to Earth along a parabolic trajectory hundreds or thousands of miles downrange from the launch site.

schedules, and other mission needs, spaceport locations in Alaska, California, Florida, and Virginia would be utilized.

1.4 NEED FOR THE PROPOSED ACTION

Advances in satellite manufacturing technology have allowed the size and mass of satellites to diminish without loss of capability. As a result, the desire for reliable, low-cost spacelift systems, particularly for small and micro RDT&E satellites, has increased in recent years. However, finding share space on some commercial or larger launch vehicles for specific orbits is not always possible or cost effective. Payloads are sometimes bumped several times before funding, the right launch opportunity, and readiness of the payload all come together (Bille and Kane, 2003).

The DOD has a long history of using small satellites to support the testing of new components prior to incorporation into large-scale operational satellite programs. In addition, a number of small and micro RDT&E satellite programs within NASA, the Department of Energy, and other US Government agencies could be supported. Low-cost target vehicles are also needed to provide realistic threat simulations for the testing of long-range ballistic missile defense systems by the DOD. Other Government missions may potentially require short-duration, sub-orbital flights for experimental purposes.

1.5 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

This EA documents the environmental analysis of implementing the OSP, which would provide enhanced capability and flexibility to the development of space launch and target vehicles using excess MM II and PK rocket motors (including use of commercial upper stages and various subsystems) to meet a wide variety of mission requirements. It is expected that all launches would be conducted from an existing Government range (Western Range or Eastern Range) and/or commercial spaceport located at Vandenberg AFB, CA; Kodiak Launch Complex, AK; Cape Canaveral AFS, FL; and Wallops Flight Facility, VA. Figure 1-1 shows the geographic locations of these launch sites.

Because only a small number of specific missions have been identified to date for the OSP, this EA takes a programmatic approach in assuming a maximum of five or six launches per year, over a 10-year period, beginning in 2005. All five or six annual launches could occur from just one of the four ranges, or be spread across the different ranges. For each range, site modifications and construction, rocket motor transportation, pre-flight preparations, flight activities, and post-launch operations are addressed. In each case, existing buildings and facilities would be used, with limited facility modifications required in most cases. Both preferred and alternate launch support facilities (if available) are considered.

In analyzing the potential environmental impacts that might occur at buildings and facilities, specific plans for their operation and any applicable site modifications were not always available because of the programmatic nature of the OSP and the future missions it would support. As a result, a complete analysis of potential impacts for some resources was not always possible during this EA process. For example, a thorough assessment of potential impacts on archaeological resources could not be accomplished at some locations because construction and engineering design plans, delineating where excavation and grading might occur, have not yet been developed. Thus, these additional environmental reviews would be completed, when necessary, prior to implementation of the Proposed Action at each building or facility selected. In the case of Vandenberg AFB and Cape Canaveral AFS, the USAF Form 813, *Request for Environmental Impact Analysis*, would be used (USAF, 2001a). If additional environmental reviews become necessary at Kodiak Launch Complex or at Wallops Flight Facility, a similar process would be applied. Each range would determine the appropriate level of environmental review and analysis that is needed.

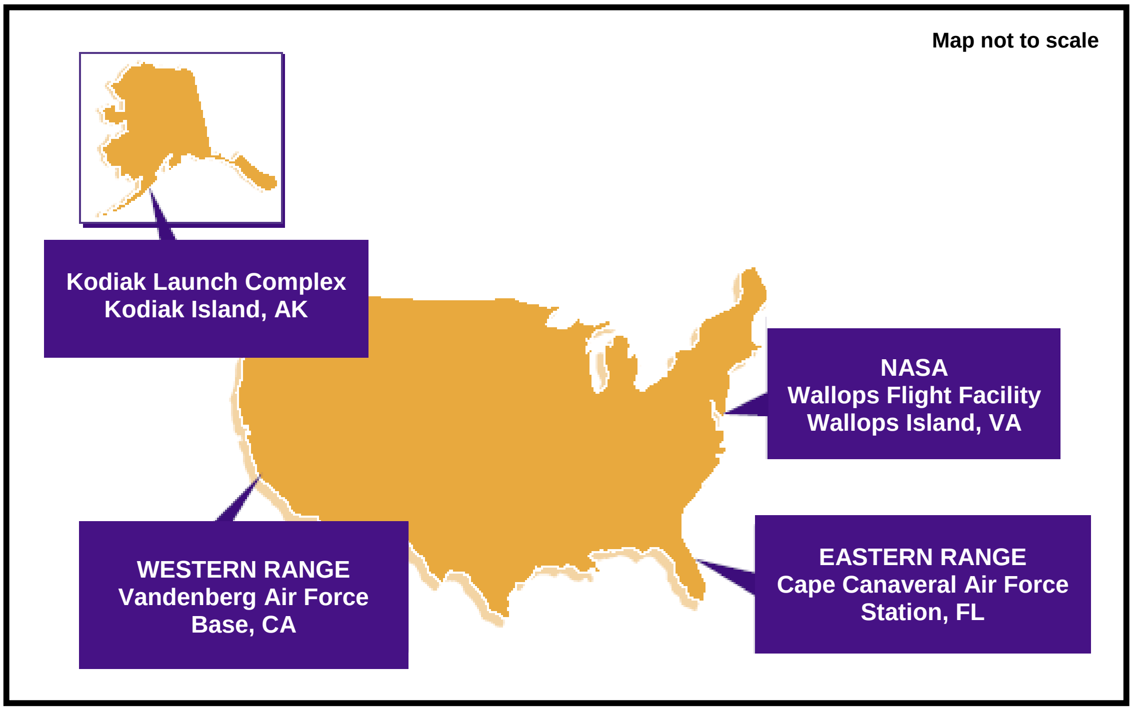


Figure 1-1. Proposed Launch Locations for the Orbital/Sub-Orbital Program

In terms of orbital missions, a wide variety of small and micro-satellites could be launched from any of the launch sites into Low Earth Orbit (LEO). Specific orbital missions identified to date for the OSP, and other representative spacecraft, are also analyzed in this EA.

As per the CEQ and USAF regulations [40 CFR 1502.14(d) and 32 CFR 989.8(d), respectively], this EA also analyzes the No Action Alternative, which serves as the baseline from which to compare the Proposed Action. Under the No Action Alternative, the OSP would not be implemented. However, some existing missions involving the use of excess ICBM assets for target launches out of Vandenberg AFB and Kodiak Launch Complex would still be conducted, in accordance with prior NEPA analyses. In addition, use of ICBM assets for orbital launch purposes would still be considered on a case-by-case basis, following appropriate NEPA reviews.

1.6 RELATED ENVIRONMENTAL DOCUMENTATION

The Acquisition Civil and Environmental Engineering Branch, Space and Missile Systems Center, Los Angeles Air Force Base, relied heavily upon several existing NEPA documents in preparing this EA. These documents are listed below and cited in the EA where applicable. Those documents that have been completed can also be accessed on the Internet at the following Los Angeles AFB web site: http://ax.losangeles.af.mil/axf.

- Cape Canaveral Air Force Station and Spaceport Florida Authority. 1994. *Finding of No Significant Impact and Environmental Assessment of the Proposed Spaceport Florida Authority Commercial Launch Program at Launch Complex-46 at the Cape Canaveral Air Station, Florida*. October.

- Federal Aviation Administration/Associate Administrator for Commercial Space Transportation. 1996. *Environmental Assessment of the Kodiak Launch Complex, Kodiak Island, Alaska*. June.

- National Aeronautics and Space Administration. 1997. *Final Environmental Assessment for Range Operations Expansion at the National Aeronautics and Space Administration Goddard Space Flight Center, Wallops Flight Facility, Wallops Island, Virginia*. October.

- National Aeronautics and Space Administration. 2001. *Environmental Assessment for the Advanced Technology Development Center at the Cape Canaveral Air Force Station Launch Complex 20, Florida*. May.

- National Aeronautics and Space Administration. 2002. *Final Environmental Assessment for Launch of NASA Routine Payloads on Expendable Launch Vehicles from Cape Canaveral Air Force Station, Florida, and Vandenberg Air Force Base, California*. June.

- National Aeronautics and Space Administration. 2003. *Final Environmental Assessment for a Payload Processing Facility, National Aeronautics and Space Administration Goddard Space Flight Center, Wallops Flight Facility, Virginia*. January.

- National Aeronautics and Space Administration. 2003. *Final Environmental Assessment for AQM-37 Operations at the National Aeronautics and Space Administration Goddard Space Flight Center, Wallops Flight Facility, Wallops Island, Virginia*. June.

- National Aeronautics and Space Administration. 2005. *Final Site-Wide Environmental Assessment for Wallops Flight Facility, Virginia*. January.

- US Army Space and Missile Defense Command. 2003. *Ground-Based Midcourse Defense (GMD) Extended Test Range (ETR) Final Environmental Impact Statement*. July.

- US Department of the Air Force. 1995. *Environmental Assessment for the California Spaceport, Vandenberg Air Force Base, California*. February.

- US Department of the Air Force. 1997. *Final Theater Ballistic Targets Programmatic Environmental Assessment, Vandenberg Air Force Base, California*. December.

- US Department of the Air Force. 1998. *Final Environmental Impact Statement for the Evolved Expendable Launch Vehicle Program*. April.

- US Department of the Air Force. 2000. *Final Supplemental Environmental Impact Statement for the Evolved Expendable Launch Vehicle Program*. March.

- US Department of the Air Force. 2004. *Final Environmental Assessment for Minuteman III Modification*. December.

- US Department of the Air Force. 2005. *Final Draft Programmatic Environmental Assessment for Demolition and Abandonment of Atlas and Titan Facilities, Vandenberg Air Force Base, California*. June.

1.7 DECISIONS TO BE MADE

Supported by the information and environmental impact analysis presented in this EA, the USAF will decide on whether to proceed in implementing the proposed OSP launches, or to select the No Action

Alternative. If the OSP is allowed to proceed, decisions on how to implement the program—in terms of which ranges and facilities to use, launch vehicle configurations, launch rates, etc.—will depend on individual mission needs, the availability of range assets, and other logistical considerations and constraints.

1.8 INTERAGENCY COORDINATION AND CONSULTATIONS

Ongoing interagency coordination is integral to the preparation of this EA. The USAF has closely coordinated with the MDA, NASA, and Federal Aviation Administration (FAA)/Office of Commercial Space Transportation (AST) as cooperating agencies during the analysis—the MDA for their involvement in supporting the analysis of the Near Field Infrared Experiment (NFIRE) mission, NASA for the use of Wallops Flight Facility as a proposed launch site for the OSP and as a potential user of the program, and the FAA/AST for their launch and launch site operator licensing responsibilities.

During public review of the Draft EA, regulatory agencies, including the appropriate field offices of the US Fish and Wildlife Service (USFWS) and the NOAA Fisheries Service, the Coastal Commission within each affected state, and the California State Historic Preservation Officer (SHPO), will be given the opportunity to comment on the document. A list of those agencies, organizations, and officials that were sent a copy of the Draft EA/FONSI is provided in Chapter 8.0. If the USAF decides to finalize the EA, agency comments received during the public review process will be incorporated into the Final EA, where appropriate, and the correspondence attached as an appendix. Additional coordination and consultations with the agencies will be conducted, as necessary.

1.9 PUBLIC NOTIFICATION AND REVIEW

As per the CEQ (2002) and USAF (2001a) regulations for implementing NEPA, the USAF is soliciting comments on this EA from interested and affected parties. A Notice of Availability for this Draft EA, and the enclosed Draft FONSI, has been published in local newspapers for each location involved. Copies of the Draft EA and Draft FONSI are being placed in local libraries or offices, in addition to being available over the Internet at http://ax.losangeles.af.mil/axf. This information is being provided in all regions affected, including Alaska, California, Florida, and Virginia.

Following the 30-day public review period (as specified in the newspaper notices), the USAF will decide whether to finalize the EA and sign the FONSI, which would allow the proposed OSP launches to proceed. If the decision is to finalize the document, the USAF will, in developing the Final EA and FONSI, take into consideration those public and agency comments received. Both the comments and discussions on how they were resolved will be included in the Final EA.

Once completed, copies of the Final EA and FONSI will be made available to those organizations and individuals who provided comments on the Draft EA/FONSI, or who specifically requested a copy of the final document. The Final EA and FONSI will also be made available over the Internet.

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Two actions are assessed in this EA—the Proposed Action and the No Action Alternative. Section 2.1 provides a description of the MM and PK launch vehicles, spacecraft and orbital missions, targets and other sub-orbital missions, launch sites, and flight scenarios. Section 2.2 provides a description of the No Action Alternative. Alternatives to the Proposed Action that were considered and eliminated from further study are discussed in Section 2.3. Lastly, a summary comparison of the environmental impacts associated with the Proposed Action and the No Action Alternative is presented in Section 2.4.

2.1 PROPOSED ACTION

2.1.1 LAUNCH VEHICLES

For the OSP, two types of launch vehicles would be used: those derived from MM systems and those derived from PK systems. Each of these would utilize excess ICBM rocket motors for the lower two or three stages, with upper stages consisting of other ICBM motors and/or commercially available motors. A description of each of these types of launch vehicles is presented in the sections that follow.

2.1.1.1 Minuteman-Derived Launch Vehicles

The MM-derived launch vehicles would consist of the following major vehicle sections: a 3- or 4-stage solid-propellant booster; a liquid-propellant auxiliary propulsion system (optional); a Guidance Control Assembly Module or Avionics Assembly; and a payload assembly for the target vehicle(s)/experimental package(s) (sub-orbital missions) or spacecraft (orbital missions), including a protective shroud for the payload (optional for target vehicles). Other separation modules or vehicle adapter sections may also be used. Depending on the number of motor stages, payload, and other mission requirements, the overall vehicle length would be approximately 60 to 63 feet (ft) [18.2 to 19.2 meters (m)], with a maximum diameter of 5.5 ft (1.7 m) and an approximate weight of 80,000 pounds (lb) [36,000 kilograms (kg)], not including mass of the payload. A diagram showing examples of MM-derived target and space launch vehicles is provided in Figure 2-1. The MM-derived launch vehicles to be used in space (orbital) missions are also referred to as Minotaur I or II vehicles, depending on the size of the payload fairing used. Both Minotaur I/II and the MM-derived target vehicles do not represent new launch systems, having been previously launched from Vandenberg AFB. Further discussions on key components of the MM-derived vehicles are provided in the sections that follow.

2.1.1.1.1 Solid-Propellant Booster

For the booster, the MM-derived launch vehicles all utilize MM II rocket motors for the first two stages, and other MM or commercial rocket motors for the third stage and fourth stage (if required). Information on each motor’s dimensions, propellant weight, chemical components, and DOD/US Department of Transportation (DOT) explosive classification is provided in Table 2-1. Motor casings are generally made either of steel, titanium, fiberglass, or carbon epoxy. The DOD explosive classification determines the method of shipping and storing of the rocket propellants and other ordnance.

During powered flight, each rocket motor uses a different Thrust Vector Control (TVC) system (steering mechanism) for pitch and yaw control. Although the TVC would vary from motor to motor, two basic

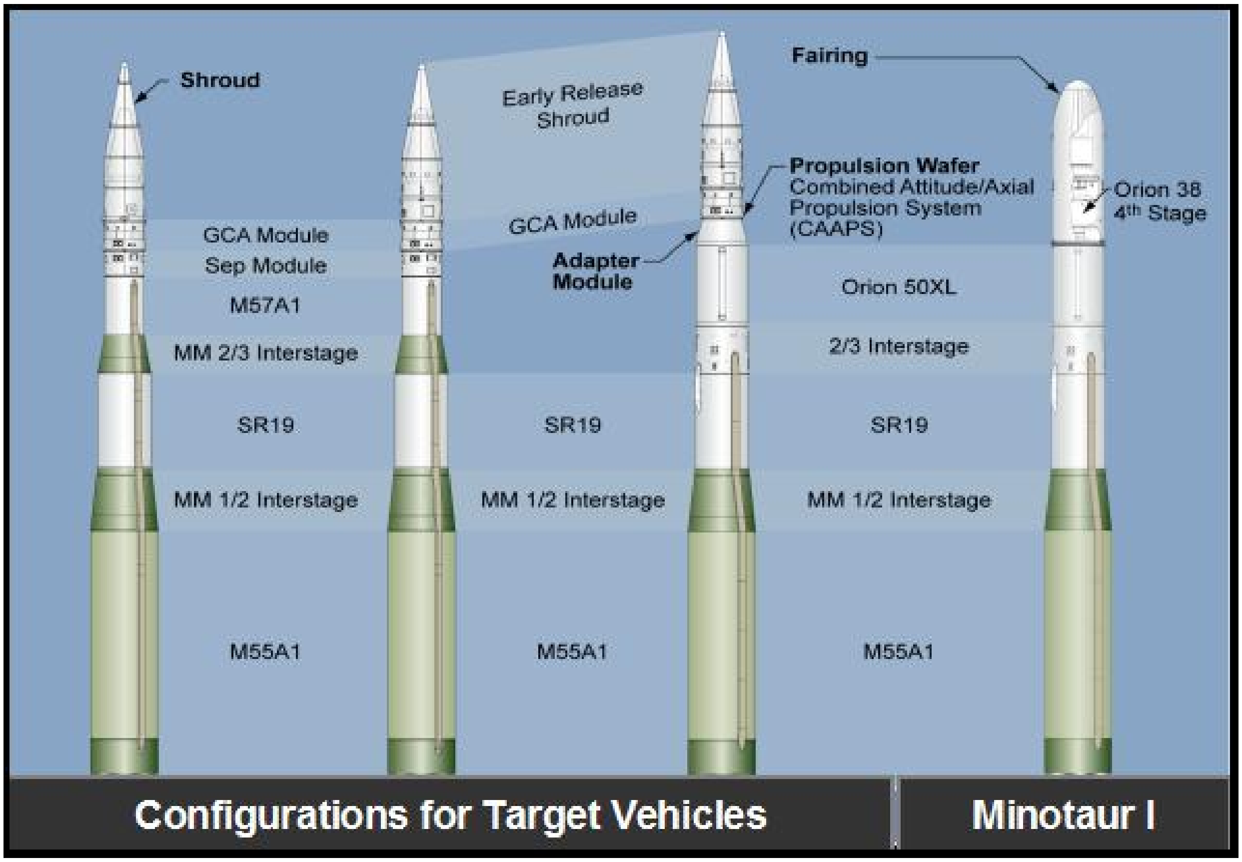


Figure 2-1. Examples of Minuteman-Derived Launch Vehicles

types are used on OSP-selected motors: hydraulically actuated moveable nozzles and liquid/gas injection. Descriptions of each and the materials they use are as follows.

- **Hydraulically Actuated Moveable Nozzles.** This type of TVC system uses a hydraulic system for moving motor exhaust nozzles to alter the thrust vector. A battery-powered motor or gaseous helium powered turbine drives a pump, which maintains hydraulic pressure. Up to several gallons of hydraulic fluid are contained in the system. The MM II M55A-1 motor—the 1st stage on all the MM-derived launch vehicles—uses this type of system.

- **Liquid/Gas Injection.** TVC is accomplished through the injection of a liquid or gas into the rocket's exhaust, which creates a shock wave in the plume that alters the thrust vector. The liquid or gas material used can vary for different motor designs. It can include such materials as perfluorohexane, or strontium perchlorate in an aqueous solution. For the MM II SR19-AJ-1 motor—2nd-stage on all the MM-derived vehicles—260 lb (118 kg) of Halon 2402 gas (also known as Freon 114B2) is used to provide directional steering. Although the Halon gas is a Class I ozone-depleting substance, it represents existing Air Force stockpile from the original MM II Program. Additionally, the Halon was sealed in the TVC tanks during manufacturing; thus, there is no requirement to top off Halon levels or transfer any Halon gas from the launch vehicles. Consequently, in accordance with Air Force Instruction (AFI) 32-7080 (*Pollution Prevention Program*), a waiver for the use of Halon 2402 gas, in this case, is not required. For each of these types of motors, pressurization of the TVC liquid or gas is accomplished using a hot-gas generator, or helium gas stored in a high-pressure tank.

Table 2-1. Solid-Propellant Rocket Motors for Minuteman-Derived Launch Vehicles						
Stage	**Motor**	**Diameter ft (m)**	**Length ft (m)**	**Propellant**		
				Quantity (approx.) lb (kg)	**Main Components**	**DOD/DOT Classification**
1st	M55A-1	5.5 (1.7)	24.6 (7.5)	45,830 (20,788)	Ammonium Perchlorate, Polybutadiene-Acrylic acid-Acrylonitrile, Aluminum	1.3
2nd	SR19-AJ-1	4.3 (1.3)	13.5 (4.1)	13,753 (6,238)	Ammonium Perchlorate, Carboxyl-Terminated Polybutadiene, Aluminum	1.3
	Orion-50XLG	4.2 (1.3)	33.7 (10.3)	33,227 (15,072)	Ammonium Perchlorate, Aluminum, Hydroxyl-Terminated Polybutadiene	1.3
3rd or 4th	Orion-50XL	4.2 (1.3)	11.8 (3.6)	8,633 (3,916)	Ammonium Perchlorate, Aluminum, Hydroxyl-Terminated Polybutadiene	1.3
	Orion-38	3.2 (1.0)	4.4 (1.3)	1,699 (771)	Ammonium Perchlorate, Aluminum, Hydroxyl-Terminated Polybutadiene	1.3
	M57A-1	3.2 (1.0)	7.1 (2.2)	3,660 (1,660)	Ammonium Perchlorate, Cyclotetramethylene Tetranitramine, Aluminum, Nitrocellulose, Nitroglycerine, Triacetin	1.1
	SR73-AJ-1	4.3 (1.3)	5.5 (1.7)	7,290 (3,307)	Ammonium Perchlorate, Carboxyl-Terminated Polybutadiene, Aluminum	1.3
	Star-48	4.1 (1.2)	6.0 (1.8) to 7.3 (2.2)	4,431 (2,010) to 5,357 (2,430)	Ammonium Perchlorate, Aluminum, Hydroxyl-Terminated Polybutadiene	1.3

An aft skirt surrounds the base of the 1st stage motor, supporting the launch vehicle while stationary on the launch stool or in the launch silo. Inter-stages are used to connect the motor stages together. A narrow raceway and cable system runs along the exterior of some or all of the stages and the inter-stages. Small amounts of ordnance, in the form of linear explosive assemblies, are used to separate the stages during flight. Other ordnance carried on the booster includes motor igniter assemblies and an ordnance destruct package to initiate a thrust termination action, should a launch anomaly occur.

2.1.1.1.2 Hydrazine Auxiliary Propulsion System (HAPS)

Enhanced insertion accuracy or support for multiple payloads can be provided as an enhanced option utilizing the Hydrazine Auxiliary Propulsion System (HAPS). The HAPS, which is mounted above the solid-propellant booster, inside the Avionics Structure, consists of a hydrazine propulsion subsystem and a stage separation subsystem. After burnout and separation from the booster, the HAPS hydrazine thrusters provide additional velocity, improved performance, and precise orbit injection (orbital missions only) for the payload. The HAPS propulsion subsystem contains approximately 130 lb (59 kg) of liquid hydrazine, and pressurized helium gas. The HAPS may also be used in target vehicle applications.

2.1.1.1.3 Guidance Control Assembly Module/Avionics Assembly

On target (sub-orbital) launch vehicles, the Guidance Control Assembly represents an inertial guidance system that directs the flight of the target missile. It senses the vehicle's position and sends commands to flight control components to keep the target on its planned trajectory. Integrated with the upper stage and/or payload assembly, the Avionics Assembly on orbital launch vehicles also directs the course of the launch vehicle. Components, within both of these systems, usually include the flight computer, telemetry transmitter, telemetry multiplexer, dual flight termination receivers, radar transponder, batteries, and harnesses.

2.1.1.1.4 Payload Assembly

Located at the top of the launch vehicle, the Payload Assembly carries one or more target vehicles/ experimental packages (sub-orbital missions) or spacecraft (orbital missions). The Payload Assembly can be up to 14 ft (4.3 m) long and about 4 ft (1.2 m) in diameter. For orbital missions and some sub-orbital missions, a two-piece protective shroud (or fairing) encloses the payload, protecting it and other launch vehicle components prior to and during the vehicle's ascent after launch. During flight, pyrotechnic bolt cutters sever shroud connections. A contained hot-gas generation system is then used to drive pistons that force the halves of the shroud open, allowing for payload separation.

2.1.1.1.5 Batteries

To provide electrical power to the MM-derived launch vehicle subsystems, several different types of batteries are carried onboard the motors and other sections of the vehicle. They consist of multiple nickel-cadmium and silver-zinc batteries, and two squib batteries. Approximately 12 batteries are carried on the launch vehicle (depending on the vehicle configuration used), each weighing from 6 to 12 lb (2.7 to 5.4 kg).

2.1.1.2 Peacekeeper-Derived Launch Vehicles

Similar to the MM-derived vehicles discussed earlier, the PK-derived launch vehicles would consist of the following vehicle sections: a 3- to 5-stage solid-propellant booster; a Guidance and Control Assembly; and a payload assembly for the target vehicle(s)/experimental package(s) (sub-orbital missions) or spacecraft (orbital missions), including a protective shroud for the payload. Depending on the number of motor stages, payload, and other mission requirements, the overall vehicle length would be approximately 71 to 76 ft (21.6 to 23.2 m) long, with a maximum diameter of 7.7 ft (2.3 m) and a weight of up to approximately 195,000 lb (88,400 kg), not including mass of the payload. The PK-derived launch vehicle to be used for OSP orbital missions is referred to as the Minotaur IV, while the target launch (sub-orbital) vehicle is called the OSP Heavy. A diagram of these launch vehicles is provided in Figure 2-2.

Nearly the same as the PK-derived launch vehicles, the PK ICBM has been flight tested at Vandenberg AFB on a regular basis since 1983. The first-stage motor to be used on the PK-derived vehicles is also the same as or equivalent to those previously used for Taurus missions launched from Vandenberg AFB, and for the Athena Program that has conducted launches from Vandenberg AFB, Kodiak Launch Complex, and Cape Canaveral AFS.

Further discussions on key components of the PK-derived vehicles are provided in the following sections.

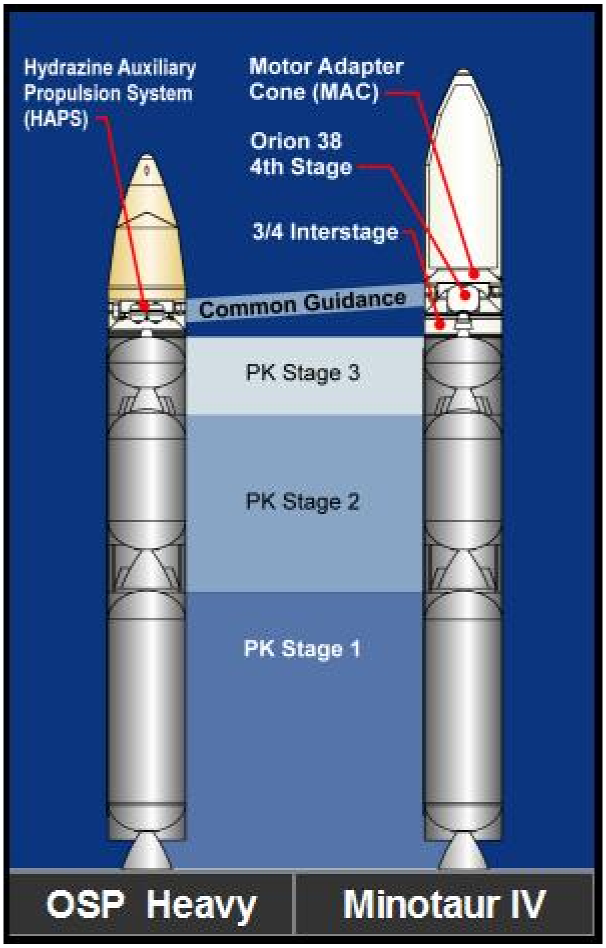


Figure 2-2. Examples of Peacekeeper-Derived Launch Vehicles

2.1.1.2.1 Solid-Propellant Booster

The PK-derived boosters utilize PK rocket motors for the first three stages, and other commercial rocket motors for the fourth and fifth stages (if required). Information on each motor's dimensions, propellant weight, chemical components, and DOD/DOT explosive classification is provided in Table 2-2. The PK motor casings are made primarily of KEVLAR® and carbon epoxy.

The TVC system on all three PK motors uses individual gas generators, with igniters, to power the hydraulically actuated moveable nozzles, similar to those previously described for some of the MM motors. Each PK rocket motor contains several gallons of hydraulic fluid. For the 4th- and 5th-stage commercial rocket motors, the TVC would be the same as described earlier for the MM-derived launch vehicle.

The base of the 1st stage motor would be supported on a launch stool prior to launch. Inter-stages are used to connect the motor stages together. A narrow raceway and cable system runs along the exterior of some or all of the stages and the inter-stages. Small amounts of ordnance, in the form of linear explosive assemblies, are used to separate the stages during flight. Just as with MM-derived boosters, other

Table 2-2. Solid-Propellant Rocket Motors for Peacekeeper-Derived Launch Vehicles						
Stage	Motor	Diameter ft (m)	Length ft (m)	Propellant		
				Quantity (approx.) lb (kg)	Main Components	DOD/DOT Classification
1st	SR-118	7.7 (2.3)	27.6 (8.4)	98,462 (44,662)	Ammonium Perchlorate, Aluminum, Hydroxyl-Terminated Polybutadiene	1.3
2nd	SR-119	7.7 (2.3)	19.7 (6.0)	54,138 (24,557)	Ammonium Perchlorate, Aluminum, Hydroxyl-Terminated Polybutadiene	1.3
3rd	SR-120	7.7 (2.3)	10.8 (3.3)	15,584 (7,069)	Ammonium Perchlorate, Aluminum, Cyclotetramethylene Tetranitramine, Nitroglycerine, Polyethylene Glycol	1.1
4th	Orion-38	3.2 (1.0)	4.4 (1.3)	1,699 (771)	Ammonium Perchlorate, Aluminum, Hydroxyl-Terminated Polybutadiene	1.3
	Star-48	4.1 (1.2)	6.0 (1.8) to 7.3 (2.2)	4,431 (2,010) to 5,357 (2,430)	Ammonium Perchlorate, Aluminum, Hydroxyl-Terminated Polybutadiene	1.3
5th	Star-37	3.1 (0.9)	5.5 (1.7)	2,350 (1,066)	Ammonium Perchlorate, Aluminum, Hydroxyl-Terminated Polybutadiene	1.3

ordnance carried onboard would include motor igniter assemblies and an ordnance destruct package to initiate a thrust termination action should a launch anomaly occur.

2.1.1.2.2 Hydrazine Auxiliary Propulsion System (HAPS)

As an option for the PK-derived launch systems, a HAPS propulsion subsystem, similar to that described for the MM-derived systems (Section 2.1.1.1.2), could be used. If used on space or target vehicle applications, the HAPS would contain approximately 130 lb (59 kg) of liquid hydrazine, and pressurized helium gas.

2.1.1.2.3 Guidance and Control Assembly

The PK-derived launch vehicles utilize a Guidance and Control Assembly, which directs the course of the launch vehicle in flight. Components contained within this system usually include the flight computer, telemetry transmitter, telemetry multiplexer, dual flight termination receivers, radar transponder, batteries, and harnesses.

2.1.1.2.4 Payload Assembly

Located at the top of the launch vehicle, the Payload Assembly carries one or more target vehicles/ experimental packages (sub-orbital missions) or spacecraft (orbital missions). It can be up to 20 ft (6.1 m) long and about 7.7 ft (2.3 m) in diameter. For orbital and sub-orbital missions, a two-piece protective shroud or fairing encloses the payload, protecting it prior to and during the vehicle's ascent after launch. During flight, either a small rocket motor would be used to eject the shroud, or linear shaped charges would be used to separate the fairing from the vehicle. Once the shroud or fairing is removed, payload separation can occur.

2.1.1.2.5 Batteries

To provide electrical power for the PK-derived launch vehicles, eight nickel-cadmium batteries are carried on the upper stage. The battery weights range from 3 to 12 pounds (1.4 to 5.4 kg) each. Two batteries are for command destruct systems, two are for ordnance, and the remainder are for avionics power.

2.1.2 SPACECRAFT AND ORBITAL MISSIONS

Under the OSP, a wide variety of small and micro-satellites could be launched from any of the proposed launch sites into LEO. Such orbits are generally 270 to 1,080 nautical miles (nmi) (500 to 2,000 km) above the earth's surface and are not in a fixed position (are not geostationary). Orbital paths can vary from equatorial to polar. Based on a 100-nmi (185-km) orbit insertion altitude, the MM-derived launch vehicles would have a maximum payload capacity of approximately 1,200 lb (545 kg), while the larger PK-derived vehicles would have the ability to boost payloads weighing more than 3,860 lb (1,750 kg). As the orbit insertion altitude increases, the payload capacities of the vehicles decrease.

Orbital missions identified to date for the OSP are the USAF's Space-Based Space Surveillance (SBSS) mission, the MDA's Near Field Infrared Experiment (NFIRE) mission, and the US-sponsored Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) mission. These specific missions, in addition to other representative spacecraft payloads, are described in the sections that follow.

2.1.2.1 Space-Based Space Surveillance

While in LEO, the SBSS spacecraft would provide timely detection, identification, and tracking of man-made space objects. This is accomplished by providing immediate maneuver detection, supporting threat determination and defensive counter space strategies, and delivering significantly improved detection and reporting of high interest space events to ensure survivability of US assets. The SBSS would also enable US forces to find, fix, and track deep-space and near-earth resident space objects, and would support the Space Surveillance Network in maintaining an accurate catalog of all resident space objects. Launch of the SBSS spacecraft is currently planned for 2008 or 2009, and would be conducted from either Vandenberg AFB or Kodiak Launch Complex.

The type and amount of onboard propellants, and other characteristics of the SBSS spacecraft, would fall within the maximum limits identified for the representative spacecraft described in Section 2.1.2.6. An illustration of the proposed SBSS spacecraft is provided in Figure 2-3.

2.1.2.2 Near Field Infrared Experiment

The MDA is embarking on an acquisition strategy that delivers the capability to intercept long-range, enemy ballistic missiles during the boost and ascent phase of their trajectory.[2] Near-field measurements

[2] In the Boost Defense Segment of Ballistic Missile Defense, ballistic missiles are intercepted prior to termination of powered flight during a time when they are moving relatively slowly and have a highly visible plume. For further information on this topic, go to the following MDA web site: http://www.mda.mil.

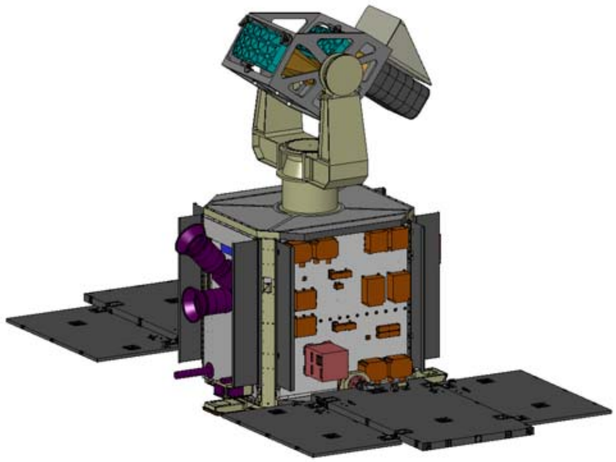


Figure 2-3. Space-Based Space Surveillance (SBSS) Spacecraft

of the exhaust plume and rocket body during boost are one area of remaining technical risk that mandates testing in a realistic space environment. The NFIRE represents a set of on-orbit experiments designed to obtain this much-needed data and reduce the risk for future terrestrial platforms (e.g., ground mobile/air deployable, sea, and potentially air) that are currently in planning.

The NFIRE spacecraft serves as a bus with a liquid hydrazine propulsion system. Composed mostly of aluminum, graphite, steel, and titanium, the spacecraft measures approximately 8.4 ft (2.6 m) high and 4.3 ft (1.3 m) wide, and weighs approximately 1,130 lb (513 kg). The onboard propulsion system would be fueled with up to 251 lb (114 kg) of liquid hydrazine propellant, with gaseous nitrogen as the pressurant. A solar panel, single hydrogen gas battery, and 11 series-connected nickel hydrogen (NiH_2) common pressure vessels would provide electrical power for the spacecraft and onboard passive infrared sensor. A drawing of the proposed spacecraft bus is shown in Figure 2-4.

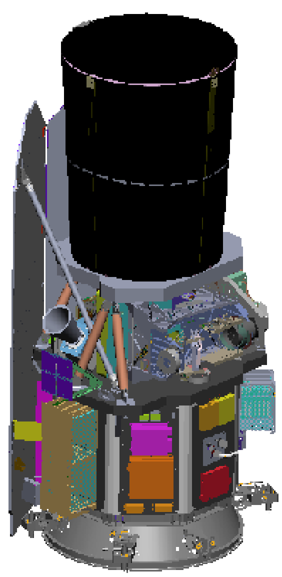


Figure 2-4. Near Field Infrared Experiment (NFIRE) Spacecraft

The NFIRE spacecraft would be launched on a MM-derived Minotaur launch vehicle from Wallops Flight Facility. Spacecraft fueling, and integration with the booster, would occur at Wallops Flight Facility.

Planned for 2006, the NFIRE spacecraft would be launched from Wallops Flight Facility on a southeasterly trajectory. When the launch vehicle reaches the desired orbit, it would deploy the NFIRE spacecraft in a low-earth circular orbit. Over the next several months, the spacecraft would use its onboard sensor to observe targets of opportunity.

Sometime after the NFIRE spacecraft is launched, two MM-derived target vehicles (described in Section 2.1.1.1) would be launched from Vandenberg AFB, several weeks or months apart. With each target flight, the NFIRE spacecraft would maneuver to a lower orbit to observe the passing target vehicle (during its final-stage burn), prior to its splashdown in the Pacific Ocean.

After the second target launch, the NFIRE bus would return to a higher altitude within LEO. There it would remain and observe static fires and other available launches. If remaining fuel permitted, the spacecraft might drop to a lower orbit for one more "near" mission if the opportunity presents itself. Otherwise, the remaining fuel would be used to maintain the parking orbit for the lifetime of the spacecraft.

2.1.2.3 Constellation Observing System for Meteorology, Ionosphere, and Climate

The COSMIC space mission is the third mission of its type initiated by the National Space Program Office of the National Science Council of Taiwan. This program is a collaborative space science mission being sponsored by several US agencies, including NASA, NOAA, the National Science Foundation, and the University Corporation for Atmospheric Research.

The primary goal of the COSMIC mission is to launch a constellation of six micro-satellites into LEO to collect atmospheric data for weather prediction, atmospheric studies, and space weather monitoring to fulfill the research and operational needs. The mission would be launched on a Minotaur I or II launch vehicle from either Vandenberg AFB or Kodiak Launch Complex in late 2005 or early 2006. Following launch and separation of all six spacecraft, the launch vehicle would perform a series of collision/contamination avoidance maneuvers to minimize contamination and potential recontact with the spacecraft. Each spacecraft would perform a series of orbital maneuvers to attain circular orbits in six orbital planes with a goal of reaching a 432-nmi (800-km) altitude.

The individual spacecraft are approximately 3.8 ft (1.2 m) in diameter and 0.5 ft (0.2 m) high, and are stacked into a "spacecraft suite" or cluster that weighs approximately 900 lb (408 kg) (see Figure 2-5). The six individual spacecraft are comprised of an integrated spacecraft platform and three science payloads: a global positioning system (GPS) occultation receiver, an ionospheric photometer, and a tri-band beacon. The onboard propulsion system for each spacecraft would use approximately 14.7 lb (6.7 kg) of hydrazine stored in a propellant tank. Non-explosive actuators would be used to separate each spacecraft following launch. Electrical power on each spacecraft would come from nickel hydride batteries.

2.1.2.4 Representative Spacecraft

The concept of a representative spacecraft provides a benchmark that describes a "bounding case" for quantities and types of materials, emissions, and instrumentation, in addition to the pre-launch activities that support the mission. Within this context, the representative spacecraft provides a comprehensive bounding design for routine orbital satellite payloads. The quantitative levels noted for the representative spacecraft were derived from prior NASA studies (NASA, 2002a) and USAF sources. Highly unusual

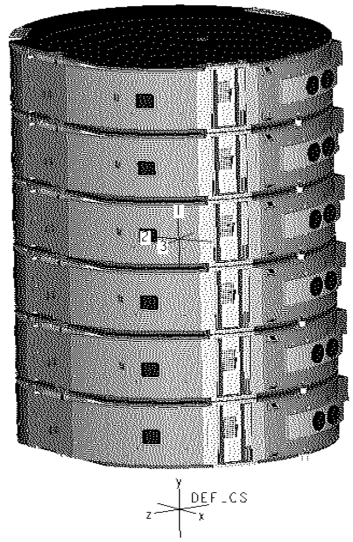


Figure 2-5. Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) Spacecraft Suite

payload characteristics with high potential for major environmental impact (e.g., radioisotope thermoelectric generators) were excluded from this bounding case. Such payload characteristics, if proposed, may require further environmental analyses beyond the scope of this EA. Of the remaining proposed payloads, spacecraft systems with minor potential for environmental impact were identified and evaluated for:

- Solid, liquid, and electric (ion) propellant types and quantities
- Laser power levels and operating characteristics
- Explosive hazard potentials
- Battery electrolyte types and quantities
- Hazardous structural materials and quantities
- Radio frequency transmitter power
- Radioisotope instrument components.

A theoretical bounding case payload was defined by the magnitudes of all of these characteristics. Staying within OSP launch vehicle capabilities for placing satellites into LEO, the representative spacecraft would have a maximum weight of 4,000 lb (1,815 kg). Table 2-3 presents the types and maximum quantities of materials that would be carried by the representative spacecraft. Minor materials that are not listed may be included on the spacecraft, as long as they pose no substantial hazard.

2.1.3 TARGETS AND OTHER SUB-ORBITAL MISSIONS

Target launch vehicles are generally used to simulate a ballistic missile threat, in both physical size and performance characteristics. Missions requiring sub-orbital target launch vehicles are normally conducted in support of DOD Ballistic Missile Defense programs for sensor and interceptor tests, which can involve missile-to-missile impacts at moderate to high altitudes. Such tests are usually conducted over broad ocean areas, distant from populated land areas. In rare cases, other forms of sub-orbital, short-duration flight experiments or demonstration flights may be conducted.

Table 2-3. Summary of Representative Spacecraft Subsystem Characteristics	
Structure	Unlimited quantities: aluminum, magnesium, carbon resin composites, steel, and titanium
	Limited quantities: beryllium [110 lb (50 kg)]
Propulsion	Solid propellant: 280 lb (127 kg)
	Mono-propellant: 460 lb (209 kg) of hydrazine
	Bipropellant fuel: 230 lb (104 kg) of MMH Bipropellant oxidizer: 280 lb (127 kg) of NTO
	Ion propulsion: 230 lb (104 kg) of xenon gas
Communications	Various 10 to 100 Watt (radio frequency) transmitters
Power	Batteries: 150 A-Hr (NiH_2); 300 A-Hr (LiSOC); 150 A-Hr (NiCd); 150 A-Hr (hydrogen gas)
	Solar panels
Instruments	10-kilowatt radar
	American National Standards Institute (ANSI) safe lasers
Other	Limited quantities of radiological materials (typically no more than a few millicuries) approved for launch by applicable USAF and NASA regulations and policies
	Class C (1.4) electro-explosive devices for mechanical systems operation and deployment

Source: Modified from NASA, 2002a

For both MM-derived and PK-derived target launch vehicles, a three-stage solid propellant booster configuration would normally be used (see Section 2.1.1). Payloads carried on target vehicles may consist of a single unshrouded payload, or one or more simulated Reentry Vehicles (RVs) protected within a temporary shroud. A single RV is conical in shape, about 6 ft (1.8 m) tall and 2.5 ft (0.8 m) wide at the base, and weighs approximately 1,300 lb (590 kg). Such RVs and other target payloads may contain a separate telemetry system, power supply, encoders, and transmitters. Used for test purposes only, target payloads typically do not contain radioactive materials, substantial quantities of high explosives, or other weapons materials.

2.1.4 LAUNCH SITES

The OSP proposes to use four existing launch sites: Vandenberg AFB, CA; Kodiak Launch Complex, AK; Cape Canaveral AFS, FL; and Wallops Flight Facility, VA. Program activities planned for each location—including (1) site modifications, (2) rocket motor transportation, (3) pre-flight preparations, (4) flight activities, and (5) post-launch operations—are described in the sections that follow.

As mentioned earlier, only a few specific missions have been identified to date for the OSP. This EA, therefore, takes a programmatic approach in assuming a maximum of five or six launches (orbital and/or sub-orbital) per year, over a 10-year period, beginning in 2005. All five or six annual launches could occur from just one of the four ranges, or could be spread out among the different ranges. Vandenberg AFB and Kodiak Launch Complex would be capable of handling up to six launches per year, while the other two ranges would each have the capability for up to five launches per year.

At each of the four ranges, existing facilities would be used. In identifying specific launch sites and support facilities at each range, the USAF applied various evaluation criteria, which are listed below. Those preferred and alternate facilities (if available) that have initially met the criteria are identified in the sections that follow.

- Minimal construction requirements
- Launch pad large enough to handle logistical support equipment [e.g., crane and Transporter-Erector (TE)]
- Power and communication lines nearby
- Acceptable launch trajectory performance (e.g., avoid doglegs along the flight path to control debris impact areas)
- Minimal environmental constraints
- Ease of operations, and quality and capability of supporting infrastructure
- Meets explosive safety siting requirements for proposed launch systems
- Avoids Strategic Arms Reduction Treaty (START) limitations and constraints
- Minimal cost and schedule constraints or risks.

It is important to note that before any proposed launch activities occur at a launch facility operating under a launch site operator license, coordination between the licensee and the FAA/AST would be required. This is necessary to ensure that the terms and conditions of the license would be met; otherwise, a modification to the license would need to be issued.

2.1.4.1 Vandenberg Air Force Base

Vandenberg AFB is the headquarters of the 30th Space Wing, which conducts space and missile launches, and operates the Western Range. The base hosts a variety of Federal agencies and commercial aerospace companies and activities, including the Spaceport Systems International (SSI) Commercial Spaceport.

In support of the OSP at Vandenberg, multiple launch sites and support facilities would likely be used, including a combination of USAF and commercially operated facilities. As the primary launch site for space (orbital) missions, the SSI Spaceport on South Base would be used to launch both MM-derived and PK-derived vehicles. The SSI Spaceport encompasses approximately 108 acres of property leased from the USAF, and consists of two key facilities: the Commercial Launch Facility (CLF) and the Integrated Processing Facility (IPF). The IPF also houses the CLF Launch Control Room and administrative offices for the launch site. Development and use of the SSI Commercial Spaceport for launches was previously analyzed in the *Environmental Assessment for the California Spaceport, Vandenberg Air Force Base, California* (USAF, 1995).

SSI currently operates the spaceport facility under a launch site operator license issued by the FAA/AST in September 2001. A launch site operator license remains in effect for 5 years from the date of issuance unless surrendered, suspended, or revoked before the expiration of the term, and is renewable upon application by the licensee (14 CFR 420.43). A license to operate a launch site authorizes a licensee to offer its launch site to a launch operator (such as the USAF) for each launch point for the type and weight class of vehicle identified in the license application and upon which the licensing determination is based. The launch site operator license authorizes SSI to conduct Government and licensed launches of orbital expendable vehicles within the small payload weight class [less than or equal to 3,300 lb (1,497 kg)], and with launch azimuths ranging from 168 to 220 degrees from true north, inclusive. Any modifications to the facility or proposed operations would require a modification to the existing launch site operator license.

The primary launch site that would be used for MM target (sub-orbital) launches is Launch Facility-06 (LF-06), which is an existing silo facility located on North Vandenberg AFB. The primary site for PK target launches is Test Pad-01 (TP-01), while the Advanced Ballistic Missile Reentry System (ABRES)-A and ABRES-B complexes are also being considered. The TP-01 and ABRES-A sites have not been used for launches in over 14 years, while the last mission launched from ABRES-B was 38 years ago. Other locations being considered for PK-derived space launches are Space Launch Complex-4 East and West (SLC-4E and SLC-4W, respectively), both of which are available for other missions, following the last Titan IV launch this year. These and other key facilities that may be used in support of the OSP at Vandenberg AFB are listed in Table 2-4. The locations of these facilities are shown in Figure 2-6, along with the range of possible launch azimuths for each launch site.

Depending on mission needs and facility availability, it is possible that other facilities at Vandenberg AFB could later be considered for payload and/or booster processing. For the OSP, it is expected that little or no modifications would be needed at most of the facilities selected for launch support operations. Some launch facilities, however, would require more extensive construction if selected.

For analysis purposes, this EA assumes that Vandenberg AFB would be capable of launching up to two PK-derived and four MM-derived vehicles in any given year during the 10-year period for the OSP. Such launch rates, however, are unlikely to occur every year at the base.

2.1.4.1.1 Site Modifications

For the LF-06 and SSI CLF launch sites, and most of the associated support facilities, no modifications are planned for the OSP.

The Integration Refurbishment Facility (IRF) would require some minor modifications if used in support of PK launches. This would include adding hydrazine-fueling capability to one of the existing bays, increasing the height of the main bay exterior roll-up door to accommodate payload assemblies, and attaching rails and anchors to the main bay floor. All modifications would be conducted within the existing building.

Remaining at the TP-01 launch site is a canister-erector that was previously used to hoist the PK from a trailer and position it vertically. Since the erector is no longer used, the steel structure would be removed. A new aboveground launch stool would need to be installed to support PK target vehicles. A scaffolding-like mobile service tower or gantry measuring approximately 80 ft (24.4 m) tall and 30 ft (9.1 m) wide would be built to provide access to different levels of the launch vehicle, similar to the example shown in Figure 2-7. I-beam rails would be installed in the existing concrete pad for the gantry to ride on. Because of their deteriorated condition (as a result of corrosion), four existing camera towers would need to be removed, and a new single tower emplaced on one of the existing tower pads. In addition, the existing fence surrounding the pad would be repaired and the fenced area expanded on the East-side of TP-01 to ensure adequate rollback clearance for the new gantry. It is expected that no off-pad areas would be disturbed. Vegetation inside and immediately outside the perimeter fence, however, would require mowing periodically to minimize fire hazards from launches.

Because of their disuse for many years, both the ABRES-A and ABRES-B complexes would require a number of modifications and upgrades to support OSP launch operations. Demolition of some existing structures would be needed to eliminate unsafe and/or unusable items. The mobile gantry at the

ABRES-A sites would need to be replaced. At ABRES-B, a new roof would be needed for the launch structures. Other modifications needed at both complexes would include refurbishment of the launch duct; installation of a launch ring; extension of power, water, and communication lines through previously disturbed areas; upgrades or replacement of existing security fencing; resurfacing or replacement of existing access roads; and periodic mowing of vegetation inside and immediately outside the perimeter fence to minimize fire hazards from launches. An engineering analysis of the ABRES-A sites would also be needed to determine if the existing pad area could support the weight of a fully loaded TE and/or

Table 2-4. List of Facilities Proposed to Support the OSP at Vandenberg AFB, California				
Facility / Building Number	**Launch System**	**Mission Type**	**Activity**	**Site Modifications for OSP**
Launch Facilities				
Launch Facility-06 (LF-06) (Bldg 1980)	MM	Target	Launch Site	None
Test Pad-01 (TP-01) (Bldg 1840)	PK	Target	Launch Site	Remove current canister-erector, install launch stool, construct mobile gantry, replace camera towers, repair and expand fencing, and clear vegetation
ABRES-A (Bldg 1788, 1797)	PK	Target	Launch Site	Some demolition and refurbishment, install launch ring, construct mobile gantry, fencing, utility line extensions, road improvements, and clear vegetation
ABRES-B (Bldg 1825, 1835)	PK	Target	Launch Site	Some demolition and refurbishment, install launch ring, fencing, utility line extensions, road improvements, and clear vegetation
Space Launch Complex-4 East (SLC-4E) (Bldg 715)	PK	Space	Launch Site	Replace mobile gantry, modify launch pad structure, install launch ring, and modify road access to pad
Space Launch Complex-4 West (SLC-4W) (Bldg 738)	PK	Target	Launch Site	Replace mobile gantry, modify launch pad structure, install launch ring, and modify road access to pad
SSI Commercial Launch Facility (CLF), (SLC-8) (Bldg 240Z) [1]	MM & PK	Space	Launch Site	None
Other Support Facilities				
SSI Integrated Processing Facility (IPF) (Bldg 375) [1]	MM & PK	Space	Payload Processing	None
Payload Assembly Building (Bldg 8415)	MM & PK	Target	Payload Processing	None
Missile Assembly Building (MAB) (Bldg 1819)	MM & PK	Space & Target	Booster/Payload Processing	None
Astrotech Payload Processing Facility (Bldg 1032)	MM & PK	Space	Payload Processing	None
Payload Processing Facility (Bldg 2520)	MM &PK	Space	Payload Processing	None
Experimental Payload Facility (XPF) (Bldg 6527)	MM & PK	Space & Target	Payload Processing	None
NASA Payload Processing Facility (Bldg 1610)	MM & PK	Space & Target	Payload Processing	None
Missile Processing Facility-2 (MPF-2) (Bldg 6816)	MM	Space & Target	Booster Processing	None
Stage Processing Facilities A & B (Bldgs 1824 and 1833)	PK	Space & Target	Booster Processing	None
Integration Refurbishment Facility (IRF) (Bldg 1900)	PK	Space & Target	Booster/Payload Processing	Add hydrazine fueling capability, increase height of main bay exterior roll-up door, and attach rails and anchors to floor

Table 2-4. List of Facilities Proposed to Support the OSP at Vandenberg AFB, California				
Facility / Building Number	**Launch System**	**Mission Type**	**Activity**	**Site Modifications for OSP**
Stage Storage Facility (576-F) (Bldg 1836)	PK	Space & Target	Motor Storage	None
Integrated Checkout Facility (Bldg 1806)	MM & PK	Space & Target	Motor/Payload Processing	None
Mechanical Maintenance Facility (Bldg 1800)	MM & PK	Space & Target	Booster/Payload Processing	None
Pegasus Assembly Building (Bldg 1555)	MM	Space & Target	Motor/Payload Processing	None
Rail Transfer Facility (Bldg 1886)	PK	Space & Target	Motor/Payload Transfer	None

[1] Commercial facility licensed by the FAA/AST.

mobile cranes. Following the engineering analysis, if it is determined that the ABRES-A sites do not have the necessary load capacity, they would be rejected from consideration for OSP missions.

The last Titan II launch from SLC-4W occurred in October 2003. The pad has since been deactivated and is currently not in use. With the last Titan IV launch from SLC-4E scheduled this year, both SLC-4 pads will be available for reuse in support of other missions. Reuse of either pad for proposed OSP missions, however, would require major modifications. As part of these modifications, the existing mobile gantry would be removed and replaced, a new launch ring installed, and the launch duct resurfaced. Because the roof area of the existing SLC-4W pad would not support the OSP launch vehicle, mobile crane, and transportation equipment, other structural and road access modifications would be needed. Pending further investigations, it may be determined that similar modifications would be needed for the SLC-4E pad.

As part of the demolition-related activities that would occur at the ABRES and SLC-4 sites, depending on which facilities are selected, explosives may be used to weaken select concrete and steel structural members. However, use of explosives for demolition activities would be a rare occurrence, and would require pre-approval from the Safety Office on base.

Note that in the preparation of this OSP EA, design plans for the ABRES and SLC-4 sites were not available, and the plans are not expected until additional engineering and operational concept studies are completed. As such, should either of the ABRES or SLC-4 sites be selected for OSP missions, additional NEPA analyses and agency consultations may be required prior to initiating construction activities and launch operations.

Also, under a separate NEPA analysis, Vandenberg AFB is in the process of completing a Programmatic EA on the demolition and abandonment of multiple Atlas and Titan Heritage program buildings and facilities that are no longer required to sustain base missions. Some of the ABRES-B and SLC-4 launch facilities, analyzed in this EA for proposed OSP missions, are included in the actions analyzed in the Programmatic EA. Thus, the USAF has been closely coordinating the preparation of both EAs.

2.1.4.1.2 Rocket Motor Transportation

Both MM and PK rocket motors would be removed from storage, and inspected and tested for flight worthiness at Hill AFB, Utah, prior to shipment to Vandenberg AFB.

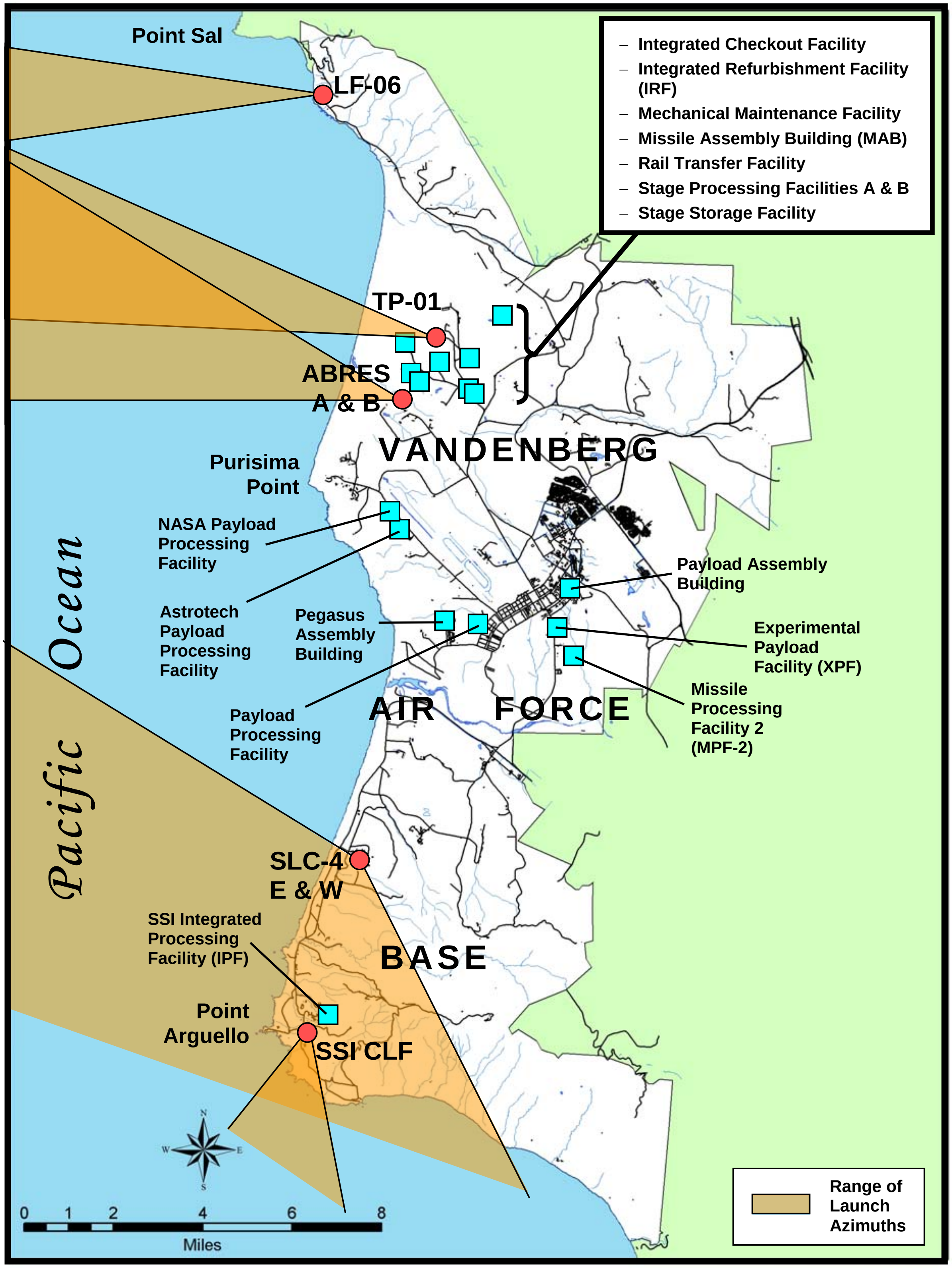


Figure 2-6. Facilities Proposed to Support the OSP at Vandenberg AFB, California

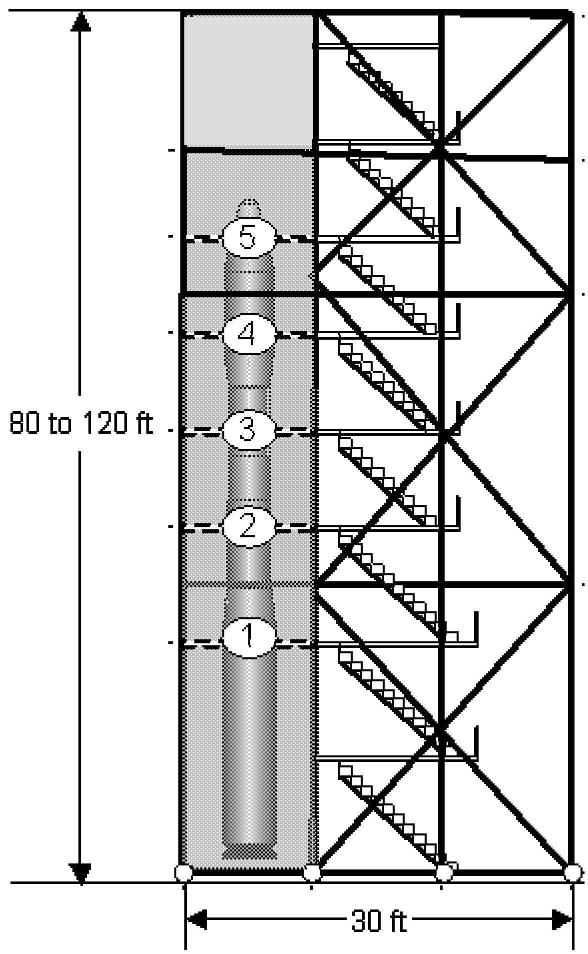


Figure 2-7. Representation of a Mobile Service Tower (Gantry)

At Hill AFB, the first two or three stages of a MM-derived launch vehicle would be integrated into a single booster stack. This would involve the M55A-1 (1st stage), SR19-AJ-1 (2nd stage), and—depending on launch vehicle configuration—an M57A-1 or SR73-AJ-1 (3rd stage) motor. From Hill AFB, the two- or three-stage booster would be transported to Vandenberg AFB by truck in a Missile Transporter (MT) trailer. The heavily constructed MT includes individual carriage supports for each motor, and environmental controls to ensure safe travel over public transportation routes.

The first three stages of PK-derived launch vehicles (SR-118, SR-119, and SR-120) would be individually shipped to Vandenberg AFB from Hill AFB by truck and/or rail using specialized equipment to handle the heavy motors. The PK 1st-stage SR-118 motor, which weighs in excess of 100,000 lb (45,360 kg), would be shipped to the base by rail whenever possible, and offloaded at the Integrated Refurbishment Facility (using overhead cranes) or at the Rail Transfer Facility (using mobile cranes). For over-the-road transportation, a multi-axle, heavy haul commercial trailer would be used. This type of semi-trailer has several steerable axles, and a suspension system that provides road shock isolation and leveling capability. A Type II semi-trailer and tractor, with eight axles, could also be used for the smaller and lighter-weight 2nd- and 3rd-stage motors (SR-119 and SR-120, respectively).

The smaller commercial motors used for both MM- and PK-derived upper stages (Orion-50XL, Orion-38, and Star-48) would most likely be shipped to Vandenberg AFB by truck directly from the manufacturer. This would also include the Orion 50XLG motor if used for the 2nd stage on MM-derived space launches, instead of the SR19-AJ-1. Each motor would be transported in a protective carriage or container.

All transportation, handling, and storage of the rocket motors and other ordnance would be accomplished in accordance with DOD, USAF, and US Department of Transportation (DOT) policies and regulations to safeguard the materials from fire or other mishap. This would include obtaining any necessary oversize/overweight hauling permits from each state where transportation would occur. The transport of MM and PK motors, and commercial motors, to Vandenberg AFB is a routine operation conducted several times a year.

To support implementation of the OSP at Vandenberg AFB and at the other proposed launch sites, a detailed transportation plan for moving MM rocket motors has been prepared (TRW, 2002). A separate transportation and handling plan for moving the larger PK rocket motors to Vandenberg AFB is also available (Northrop Grumman, 2005). These plans address the shipping and handling of the motors using air, road, rail, and/or water modes of transport, and applicable regulatory requirements.

2.1.4.1.3 Pre-Flight Preparations

Once the rocket motors or booster arrive at Vandenberg, they would be inspected and taken either to an existing bunker for temporary storage or moved directly to one of the motor/booster processing facilities listed in Table 2-4 to initiate booster integration and checkout. During motor/booster processing, a destruct package with small quantities of ordnance would be added. The purpose of the destruct package is to terminate motor thrust if unsafe conditions develop during powered flight.

Following booster processing and integration for MM-derived launch vehicles, the lower stack assembly would be transferred to a TE and driven to the designated launch site. Once at the launch pad, the TE would be secured with tie-downs. The TE is used to erect the booster assembly into a vertical position. For operations at the SSI CLF, a crane would be used to lift the booster assembly from the TE and position it onto the launch stool. After placement of the lower stack assembly, the mobile work stand is positioned to provide access to the upper end in preparation for integration of the upper stack. The TE is then used again to transport the upper motor stack and payload assembly from the designated processing facility. The erection process is repeated at the CLF launch site, completing the MM launch vehicle's assembly.

For three-stage MM target launches from LF-06 on North Base, the TE would lower the vehicle into the silo in preparation for launch. The target payload assembly is then transported in a payload transporter to the LF for placement on top of the booster. Prior to each launch at LF-06, a protective silicon rubber sealant is manually applied (not sprayed) to cable pass-through holes and other openings along the launch tube walls of the LF. This sealant prevents rocket exhaust gases from damaging the facility.

As for PK-derived launch vehicles, the PK motors would be transported individually to the designated launch site, where a mobile crane would stack them on the launch stand one at a time. The payload assembly is installed last. The mobile gantry would provide worker access to each stage of the launch vehicle. This general process of launch vehicle integration would be used at any of the proposed PK launch sites at Vandenberg AFB (i.e., TP-01, ABRES-A or -B, SLC-4E or -4W, and SSI).

Orbital spacecraft and sub-orbital target payloads would arrive at Vandenberg AFB via truck or military aircraft and be taken to one of the payload processing facilities listed in Table 2-4. The spacecraft and target systems would be processed about the same time as the booster components. At the processing facility, various system and subsystem tests would be conducted, as well as the loading of liquid propellant(s) onto payloads, if required. Fueling of the HAPS (if used) would also occur at this time. The one or more spacecraft would then be integrated with the upper booster stack (MM-derived vehicles only) and encapsulated with a protective shroud or fairing. MM-derived target payloads/RVs may or may not require a shroud. For PK-derived launch vehicles, the payload assembly, containing the spacecraft or RVs, is transported to the launch site separately for installation onto the completed booster stack.

2.1.4.1.4 Flight Activities

On the day of launch, final vehicle closeout and appropriate arming operations are performed. At each launch site, the gantry is retracted in preparation for countdown and launch. Launch operations at the CLF are conducted from the IPF Launch Control Room, which is located on the hardened side of the IPF. The control centers for the other proposed OSP launch sites are located in facilities remote from the launch sites.

Prior to conducting each launch, USAF personnel conduct a comprehensive safety analysis to determine specific launch and flight hazards. A standard dispersion computer model, run by installation safety personnel, would be used for both normal and aborted launch scenarios. As part of this analysis, risks to off-base areas and non-participating aircraft, sea vessels, and personnel are determined. The results of this analysis are used to identify the launch hazard area, expended booster drop zones, and a terminal hazard area for shroud components, RVs, or other sub-orbital payloads. A flight termination boundary along the vehicle flight path is also predetermined, should a launch vehicle malfunction or flight termination action occur. The flight termination boundary defines the limits at which command flight termination would be initiated in order to contain the vehicle and its debris within predetermined hazard and warning areas, thus minimizing the risk to test support personnel and the general public.

As a normal procedure, commercial and private aircraft, and watercraft, are notified of all the hazard areas several days prior to launch through a Notice to Airmen (NOTAM) and Notice to Mariners (NOTMAR), respectively. Within a day prior to each launch, radar, helicopters, and other remote sensors are used to verify that the hazard areas are clear of non-mission-essential aircraft, vessels, and personnel. Recreational areas in the vicinity of the base may require closure for some launches—typically for less than a day—depending on the launch site and launch trajectory used. Train movements through the base are also coordinated and monitored.

The USAF also notifies oilrig companies of an upcoming launch event several days in advance. The notification requests that operations on the oilrigs, in the path of the launch vehicle overflight, be temporarily suspended and personnel evacuated or sheltered.

Should a launch vehicle head off course or should other problems occur during flight, the Missile Flight Control Officer would activate the destruct package on the vehicle. The signal to destruct is initiated by receipt of a radio command from the base. The destruct package also contains the logic to detect a premature separation of the booster stages and initiate a thrust termination action on its own. Thrust is terminated by initiation of an explosive charge that splits or vents the motor casing, releasing pressure and essentially stopping propellant combustion. This would stop the vehicle's forward thrust, and the vehicle would then fall along a ballistic trajectory into the ocean.

2.1.4.1.5 Post-Launch Operations

Following vehicle liftoff from the launch pad, the pad would be checked for safe access. Post-launch activities would include inspection of the launch pad facilities, launch platform, and equipment for damage, as well as general cleanup and performance of maintenance and repairs necessary to accommodate the next launch cycle.

For launches from the LF-06 silo, post-launch refurbishment includes the replacement of cables and other damaged components, and the painting of components (e.g., launch vehicle suspension system) for corrosion control. In addition, the silicon rubber sealant applied to the tube walls, prior to launch, must be scraped from holes and openings, and collected in a single 55-gallon (gal) [208-liter (L)] drum for disposal as a hazardous waste. Also, after every four flights, the walls of the launch tube are hand brushed to remove accumulated blast residues. The residues are swept up and collected in 55-gal (208-L) drums for disposal as hazardous waste.

The expended rocket motors and other vehicle hardware are not recovered from the ocean following flight.

2.1.4.2 Kodiak Launch Complex

Kodiak Launch Complex is located on Narrow Cape of Kodiak Island, Alaska, approximately 44 mi (71 km) south of the city of Kodiak by road and 250 mi (402 km) south of Anchorage. The complex was built and is operated by the Alaska Aerospace Development Corporation (AADC). Development and use of Kodiak Launch Complex for launches was previously analyzed in the *Environmental Assessment of the Kodiak Launch Complex, Kodiak Island, Alaska* (FAA/AST, 1996). The Kodiak Launch Complex is licensed by FAA/AST to conduct up to nine launches per year. The *Ground-Based Midcourse Defense (GMD) Extended Test Range (ETR) Final Environmental Impact Statement* (USASMDC, 2003) analyzed the impacts of five of these nine launches being used for missile defense testing.

The FAA/AST issued a license to the AADC for the operation of a launch site at the Kodiak Launch Complex in 1998, which allowed for the first sub-orbital launch from the site in November 1998 and the first orbital launch in September 2001. For continued operation of the site, the FAA/AST issued a license renewal in 2003. The launch site operator license authorizes AADC to operate a facility to launch Government and licensed launches of vehicles weighing less than 500,000 lb (226,800 kg) total with solid rocket motor primary stages less than 369,000 lb (167,380 kg) of Class 1, Division 3 explosives. Any modifications to the facility or proposed operations would require a modification to the existing launch site operator license.

The Kodiak Launch Complex is an all-weather complex located on 3,717-acres of state owned land. The primary facilities, which would be used in support of the OSP, are listed in Table 2-5 and shown in Figure 2-8, along with the range of possible launch azimuths for the site.

Table 2-5. List of Facilities Proposed to Support the OSP at Kodiak Launch Complex, Alaska

Facility / Building	Activity	Site Modifications for OSP
Launch Service Structure/Pad 1 [1]	Launch Site	None
Integration and Processing Facility [1]	Motor/Payload Processing	None
Payload Processing Facility [1]	Payload Processing	None

[1] Commercial facility licensed by the FAA/AST.

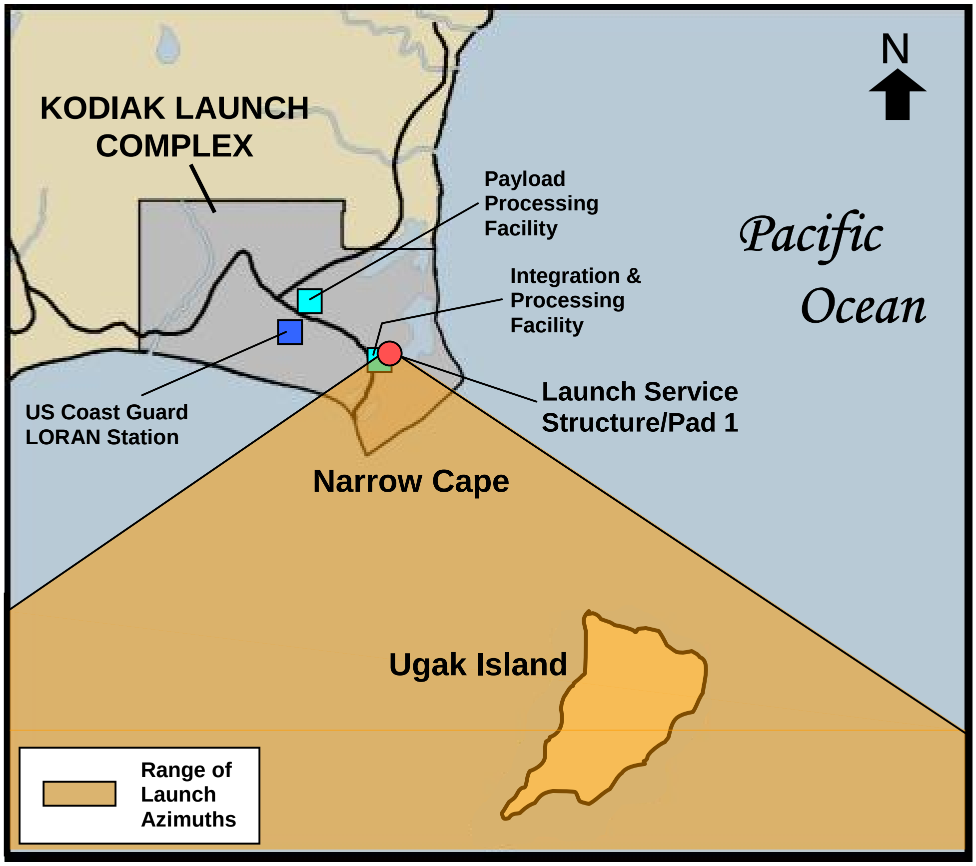


Figure 2-8. Facilities Proposed to Support the OSP at Kodiak Launch Complex, Alaska

For analysis purposes, this EA assumes that Kodiak Launch Complex would be capable of launching up to two PK-derived and four MM-derived vehicles in any given year during the 10-year period for the OSP. Such launch rates, however, are unlikely to occur every year at the complex.

2.1.4.2.1 Site Modifications

The Launch Pad and Service Structure is an environmentally conditioned facility that allows the launch vehicle and payload to be readied for launch entirely indoors. The Launch Service Structure lifts the spacecraft assembly from the horizontal to the vertical position and encloses it until the time of launch. The Launch Service Structure has adjustable work platforms with custom designed inserts that accommodate MM- and PK-derived vehicles, launch stools for both the PK and MM family of vehicles, and a flame trench rated for vehicles larger than those proposed for use under the OSP.

Because of recent facility improvements at Kodiak Launch Complex, no site modifications would be needed to support OSP launches.

2.1.4.2.2 Rocket Motor Transportation

Two options are available for the shipment of rocket motors to Kodiak Launch Complex. The motors can be flown into the Kodiak airport or ocean barged to the Lash Wharf located on Women's Bay, 8 mi (12 km) south of the City of Kodiak.

Individual MM motors, the PK 3rd-stage motor (SR-120), and commercial rocket motors would most likely be flown from Hill AFB, or from other USAF installations (depending on location of the motor supplier), directly to Kodiak airport. Either C-141, C-17, or C-5 military transport aircraft would be used. The airport is restricted to the delivery of DOD Classification 1.1 explosives after normal airport operations, which is from 2300 to 0700. The explosive quantity-distance radius from the offloading site for Class 1.1 explosives encroaches on the airport terminal inhabitance. Therefore, rocket motor shipments must arrive after the 2300 closing time, and must depart the airport area before airport operations resume at 0700.

Because of their higher weights, PK 1st- and 2nd-stage motors (SR-118 and SR-119, respectively), and integrated MM booster stacks, would need to be transported by sea from existing port facilities in Seattle, Washington, to Kodiak Island. The ocean transport of similar-size rocket motors from Seattle to Kodiak Island was previously conducted for the Athena program in 2001.

In a similar manner as used for Vandenberg AFB, the MM booster stack would be shipped from Hill AFB to Seattle over public roads in an MT trailer. The two PK motors would be shipped from Hill AFB to Seattle by rail whenever possible. If the motors were to be shipped by truck, a multi-axle heavy haul commercial trailer would likely be used, especially for the PK 1st-stage motor. A Type II semi-trailer and tractor could also be used for the smaller and lighter-weight PK 2nd-stage motor. During transit over public roads and transfer at the port facilities, the motors cannot be parked at any point for a period of more than 24 hours, in accordance with DOD, US Coast Guard, and local regulations. In Seattle, only port facilities licensed to handle explosives and hazardous materials, including rocket motors, would be used.

From Seattle, the trip up the Canadian and Alaskan coasts would take approximately 11 days and four ports-of-call before arriving at Lash Wharf on Kodiak Island. With favorable tide conditions, this arrangement would allow for a straight drive-off for the MT or heavy hauler from the barge. As an option, large boom cranes are available for offloading containerized rocket motors. Lash Wharf is also licensed to handle explosives and hazardous materials, including rocket motors.

The roads on Kodiak Island are bound by seasonal weight/load restrictions that are imposed by the Alaska DOT for all vehicles over 10,000 lb (4,536 kg) Gross Vehicle Weight (GVW). Such restrictions can reduce the allowable GVW by as much as 50 percent, depending on conditions. The restrictions are very dependent upon weather and frost depths. Though a portion of the road going south to Kodiak Launch Complex is currently unpaved crushed rock, it is scheduled for paving in 2005.

Just as described earlier for Vandenberg AFB, the transportation, handling, and storage requirements for rocket motors and related ordnance would be accomplished in accordance with DOD, USAF, US DOT, and applicable US Coast Guard policies and regulations to safeguard the materials from fire or other mishap. This would include obtaining any necessary oversize/overweight hauling permits from each state where transportation would occur.

In addition, the Alaska DOT requires a lead pilot vehicle for oversize and large hazardous material movements. All vehicles would be outfitted with the necessary communication equipment. These vehicles and personnel would control traffic through narrow or curved areas where there is not enough room for two vehicles to pass. They would also warn motorists of the oncoming vehicle or convoy, and transmit to the vehicle or convoy any forward anomalies. A team of personnel experienced in explosive ordnance handling would trail the convoy from Kodiak airport, or Lash Wharf, south to Kodiak Launch Complex.

As previously described for Vandenberg AFB, a detailed transportation plan for moving MM rocket motors has been prepared (TRW, 2002). A similar plan for the shipping and handling of PK rocket motors to Kodiak Launch Complex would also be developed prior to any missions at the complex that would utilize PK-derived launch vehicles.

2.1.4.2.3 Pre-Flight Preparations

The rocket motors would arrive at the Integration and Processing Facility. This facility is used to receive, stage, process, and check out components before being moved to the Launch Service Structure/Pad 1. The processing of target and spacecraft payloads would be conducted in the Integration and Processing Facility, or in the Payload Processing Facility's clean room. If required, liquid fueling of the payload and HAPS (if used) could be conducted at either of these two facilities.

After completion of booster processing and integration for MM-derived launch vehicles, the lower stack assembly would be transferred to a TE and driven to the launch facility. Once secured with tie-downs, the TE would erect the booster into a vertical position. The lower stack would be off-loaded from the TE using the existing 75-ton (68-metric ton) bridge crane in the Launch Service Structure, and placed on the launch stand. The process is then repeated for the upper stack/payload assembly. For PK-derived launch vehicles, motor stages and the payload assembly would be individually stacked on the launch stand using the Launch Service Structure's bridge crane. The Launch Service Structure would enclose the launch vehicle until the day of launch to provide environmentally controlled conditions for workers and to meet vehicle/payload thermal conditioning specifications.

For public safety, access to beach and other recreational use areas may be restricted for hours at a time during hazardous operations (e.g., stacking rocket motors on the launch pad) in accordance with procedures specified in the Kodiak Launch Complex Range Safety Manual (AADC, 2003a).

2.1.4.2.4 Flight Activities

When a rocket launch is planned, a Launch-Specific Safety Plan is prepared to identify the potential hazards and describe the system designs and methods employed to control the hazards. Booster drop zones and debris impact areas are pre-determined by the Range Safety Office. Clearance areas are identified, encompassing the maximum probable distribution of debris or impact points of rocket components.

The Range Safety Office would communicate the extent of the clearance area, time, and date of the flight, once they are defined, to the FAA regional air traffic office, the US Coast Guard, and local police jurisdictions for assistance in the clearance of designated land and sea-surface areas. NOTAMs and NOTMARs would be issued at least 24 hours prior to launch. Other areas under the initial flight path, but not in a predicted impact or debris area, would be monitored before the test event to determine the location of population or traffic. If the Range Safety Office determined that the population or ship traffic was in a safe position, the test would proceed. Based on operational experience at Kodiak Launch Complex, public access to Narrow Cape would be denied to meet safety and security concerns on average 5 hours in total per launch mission.

Should the launch vehicle head off course, such that it departs from its predicted flight corridor, the Mission Flight Control Officer would activate the onboard destruct package. This would stop the flight vehicle's forward thrust, and the vehicle would fall into the ocean. This impact could occur outside cleared areas, but within a wider predetermined impact corridor.

2.1.4.2.5 Post-Launch Operations

After each launch, the pad area would be checked for safe access. The launch pad facilities and equipment would be inspected for damage and cleaned, as necessary. Equipment maintenance and any repairs would also occur to accommodate the next launch cycle.

Again, the expended rocket motors and other vehicle hardware are not recovered from the ocean following flight.

2.1.4.3 Cape Canaveral Air Force Station

Cape Canaveral AFS falls under the command of the 45th Space Wing headquartered at Patrick AFB, which is located 20 mi (32 km) south of the Cape. As part of the Eastern Range, the Cape supports a wide range of space launches for both US Government and commercial satellites.

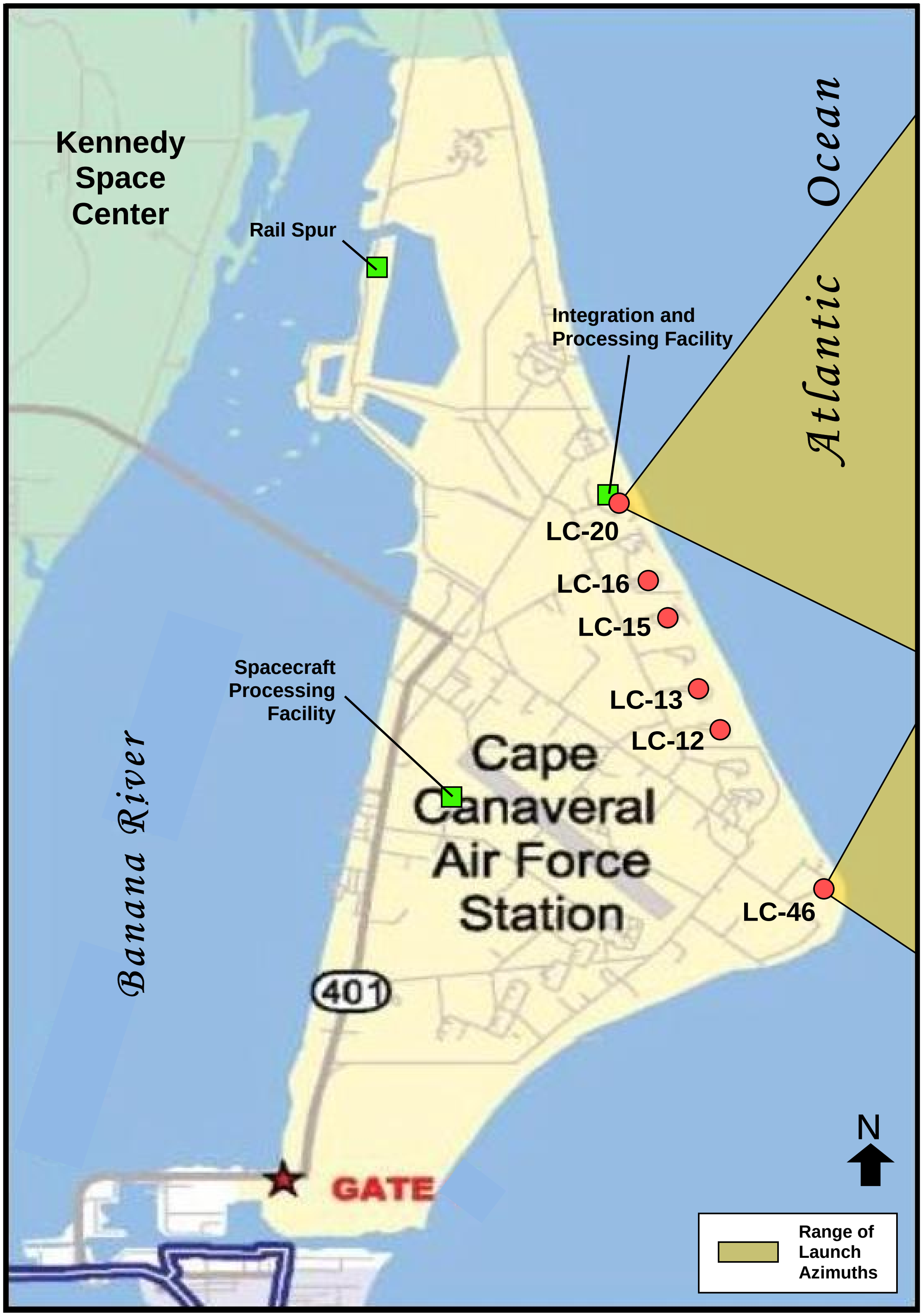
In support of the OSP at the Cape, Government operated facilities would most likely be used. Although the selection of specific facilities for OSP use has not yet been determined, there are several possible launch complexes at the Cape that could support OSP missions. They include Launch Complexes (LC) 12, 13, 15, 16, 20, and 46, which are shown in Figure 2-9. For analysis purposes in the preparation of this EA, only LC-20 and LC-46, the two outermost complexes within this group, were analyzed in detail as representing the range of possible launch sites that could be used in support of the OSP. These two launch sites are further described below.

LC-46 is considered one of the best launch sites at the Cape because of its remoteness on the far eastern side of the installation. Development and use of LC-46 for spaceport operations was previously analyzed in the *Finding of No Significant Impact and Environmental Assessment of the Proposed Spaceport Florida Authority Commercial Launch Program at Launch Complex-46 at the Cape Canaveral Air Station, Florida* (CCAFS/Authority, 1994). Conducting launches from LC-46 would require approval from the Navy and coordination with the Naval Ordnance Test Unit (NOTU). Use of this facility would also require satisfactory resolution of START treaty issues associated with Peacekeeper-derived launch vehicles.

LC-20 provides a processing and launch capability for small-scale rockets. This capability is currently being augmented with additional facilities for NASA's Advanced Technology Development Center (ATDC), which will provide resources for the research, development, demonstration, testing, and qualification of spaceport and range technologies (NASA, 2001b). Initial development of the ATDC should be completed in 2006. Conducting OSP launches from LC-20 would require approval from NASA, and sharing use of the launch complex with ATDC operations.

Table 2-6 lists representative facilities that could potentially be used in support of the OSP at Cape Canaveral AFS. The locations of these facilities are also shown on Figure 2-9, along with the range of possible launch azimuths for LC-20 and LC-46. Once OSP mission needs and facility availability are determined, other facilities at the Cape may also be considered. For the OSP, it is expected that little or no modifications would be needed for any of the facilities selected for launch support operations. Depending on which facilities at Cape Canaveral AFS are eventually selected for the OSP, additional environmental analyses beyond this EA may be required prior to initiating facility modifications and launch operations.

For analysis purposes, this EA assumes that Cape Canaveral AFS would be capable of launching up to two PK-derived and three MM-derived vehicles in any given year during the 10-year period for the OSP. Such launch rates, however, are unlikely to occur every year at the station.



Note: In preparation of this EA, only two of the possible launch sites (LC-20 and LC-46) were analyzed in detail.

Figure 2-9. Representative Facilities Proposed to Support the OSP at Cape Canaveral AFS, Florida

Table 2-6. List of Representative Facilities Proposed to Support the OSP at Cape Canaveral AFS, Florida		
Facility / Building	**Activity**	**Site Modifications for OSP**
Launch Complex-20 (LC-20)	Launch Site	Install launch stool, construct mobile gantry with an environmental shelter, and install tie-downs for the TE
Launch Complex-46 (LC-46)	Launch Site	Install tie-downs for the TE, a new launch ring, and an environmental shelter inside the existing Mobile Service Structure
Integration and Processing Facility at LC-20	Motor/Payload Processing	None
Spacecraft Processing Facility	Payload Processing	None
Rail Spur	Motor/Payload Transfer	None

2.1.4.3.1 Site Modifications

Most likely for any LC selected, some level of site modifications would be necessary. At LC-46, for example, several modifications would be needed. For the TE to be positioned next to the launch stool, it must be supported in six places to erect MM-derived boosters. Two pylon pads, two erector jack pads, and two gear pad footings would be installed in the existing concrete pad. An existing launch stool would be bolted over the existing flame exhaust duct used previously for Navy Trident missile launches. The stool, however, would require installation of a new launch ring to accommodate MM or PK 1st-stage motors. In addition, an environmental enclosure may need to be built inside the existing Mobile Service Structure (MSS) or gantry in order to keep the launch vehicle sufficiently cool during hot weather. As an alternative to the shelter, a cooling blanket could be wrapped around the rocket motors prior to launch. All site construction and/or modifications would be limited to the existing concrete pad and MSS.

At LC-20, a launch stool would be installed and a mobile gantry approximately 90 to 120 ft (27.4 to 36.6 m) high and 30 ft (9.1 m) wide would be constructed on rails, similar to that described earlier for Vandenberg AFB and shown in Figure 2-7. Just as with the existing MSS at LC-46, an environmental shelter would be integrated with the new gantry. Construction is expected to occur within existing paved areas. Should construction require excavation and/or the clearing of vegetation, additional environmental analyses and agency consultations beyond this EA would be necessary before such construction could occur.

2.1.4.3.2 Rocket Motor Transportation

Just as described earlier for Vandenberg AFB, the first two or three stages of a MM-derived launch vehicle would likely be shipped from Hill AFB to Cape Canaveral AFS over public roads in an MT trailer. Smaller commercial motors for the upper stages would either be trucked or flown directly to the Cape, which has a runway accessible to C-141, C-17, and C-5 aircraft.

The PK motors would be shipped from Hill AFB to Cape Canaveral AFS by rail whenever possible. If the motors were to be shipped by truck, a multi-axle heavy haul commercial trailer would likely be used, especially for the PK 1st-stage motor (SR-118). A Type II semi-trailer and tractor could also be used for the smaller and lighter-weight PK 2nd- and 3rd-stage motors (SR-119 and SR-120, respectively). Travel would be mostly over interstate highways and would take approximately 8 to 9 days.

When shipped by rail to Cape Canaveral AFS, the PK motors would likely be off-loaded from rail cars at an existing rail spur, such as the one located on the northwest side of the station (Figure 2-9). Two mobile cranes would off-load each PK motor from the rail car to a trailer.

Just as described earlier for Vandenberg AFB, the transportation, handling, and storage requirements for rocket motors and related ordnance would be accomplished in accordance with DOD, USAF, and US DOT policies and regulations to safeguard the materials from fire or other mishap. This would include obtaining any necessary oversize/overweight hauling permits from each state where transportation would occur. A detailed transportation plan for moving MM rocket motors has been prepared (TRW, 2002). A similar plan for the shipping and handling of PK rocket motors to Cape Canaveral AFS would also be developed prior to any missions at the station that would utilize PK-derived launch vehicles.

2.1.4.3.3 Pre-Flight Preparations

Both MM and PK payloads could be processed in the Spacecraft Processing Facility. Within one of the facility clean rooms, satellites and other payloads would undergo system checks and encapsulation. If required, liquid fueling of the payload and HAPS (if used) would occur here as well.

Upon arriving at Cape Canaveral AFS, the rocket motors would likely be taken to the Integration and Processing Facility at LC-20 for storage, inspection, and booster integration. Payload processing and horizontal integration (MM-derived vehicles only) could also be conducted here.

At the selected LC, the lower and upper stack/payload assembly of a MM-derived launch vehicle would be off-loaded from a TE by crane and placed on the launch stool in a similar manner as described for SSI operations at Vandenberg AFB in Section 2.1.4.1. Motor stages and the payload assembly for PK-derived launch vehicles would also be individually stacked on the launch stool. The MSS or gantry would enclose the launch vehicle until the day of launch to provide multi-level access to the launch vehicle, and to provide environmentally controlled conditions for workers and the launch vehicle.

2.1.4.3.4 Flight Activities

When a rocket launch is planned, the booster drop zones and debris impact areas are pre-determined by the Range Safety Office using the same methods used at Vandenberg AFB (Section 2.1.4.1). Clearance areas are defined by the Range Safety Office to encompass the maximum probable distribution of debris or impact points of rocket components. Within a day prior to each launch, radar, helicopters, and other remote sensors are used to verify that the hazard areas are clear of non-mission-essential aircraft, vessels, and personnel. NOTAMs and NOTMARs would be sent out several days ahead of time. Other areas under the flight path but not in a predicted impact or debris area would be monitored before the test event to determine the location of population or traffic. If the Range Safety Office determined that the population or ship traffic was in a safe position, the test would proceed.

Should the launch vehicle head off course, leaving its predicted flight corridor, the Range Safety Officer would activate the onboard destruct package. This would stop the flight vehicle’s forward thrust, and the vehicle would fall into the ocean. This impact could occur outside cleared areas, but within a predetermined flight corridor.

2.1.4.3.5 Post-Launch Operations

After each launch, the pad and surrounding area would be inspected and any damage repaired to ready the facility for the next launch, just as described earlier for Vandenberg AFB.

As previously noted, the expended rocket motors and other vehicle hardware would not be recovered from the ocean following flight.

2.1.4.4 Wallops Flight Facility

NASA Goddard Space Flight Center`s Wallops Flight Facility, located on Virginia's Eastern Shore, is one of the oldest launch sites in the world. The facility encompasses more than 6,000 acres over three different land parcels: the Main Base, the Mainland, and the Wallops Island Launch Site. The Mainland and the Wallops Island Launch Site are located just a few miles south of the Main Base.

For the OSP, a combination of NASA and Mid-Atlantic Regional Spaceport (MARS) commercial facilities would be used to conduct launches. Two MARS-operated launch pads are located on Wallops Island Launch Site: Launch Pad 0-B (primary site) and 0-A (secondary site). Both sites are capable of supporting a variety of small- and medium-sized expendable launch vehicles. Establishment and operation of the Spaceport for launches was previously analyzed in the *Final Environmental Assessment for Range Operations Expansion at the National Aeronautics and Space Administration Goddard Space Flight Center, Wallops Flight Facility, Wallops Island, Virginia* (NASA, 1997). A launch site operator license was issued in December 1997 to operate the commercial launch facility, which was later renewed in December 2002. The current launch site operator license allows the MARS to conduct up to 12 launches per year from the facility. The license requires that launches from the facility not have impacts greater than those associated with launching 12 Athena-3 vehicles.[3] Any modifications to the facility or proposed operations would require a modification to the existing launch site operator license.

Table 2-7 lists key NASA and MARS facilities that may be used in support of the OSP at Wallops Flight Facility. The locations of these facilities are also shown in Figure 2-10, along with the range of possible launch azimuths for each site.

For analysis purposes, this EA assumes that Wallops Flight Facility would be capable of launching up to two PK-derived and three MM-derived vehicles in any given year during the 10-year period for the OSP. Such launch rates, however, are unlikely to occur every year at the facility.

Table 2-7. List of Facilities Proposed to Support the OSP at Wallops Flight Facility, Virginia

Facility / Building	Activity	Site Modifications for OSP
Launch Pad 0-B [1]	Launch Site	None
Launch Pad 0-A [1]	Launch Site	Install new launch stool and refurbish multi-level vertical service tower
Hazardous Assembly/ Processing Facility (Bldg W-65)	Motor/Payload Processing	None
Hazardous Processing Facility (Bldg Y-15)	Payload Processing & Fueling	None
Payload Processing Facility	Payload Processing	None

[1] Commercial facility licensed by the FAA/AST

[3] The Athena 3 is a multi-stage launch vehicle that includes two Castor 120 solid-propellant motors and several strap-on motors. The vehicle length is about 92 ft (28 m) and it has an approximate launch weight of 323,640 lb (146,800 kg). No Athena 3 vehicles have yet been launched from Wallops Flight Facility.

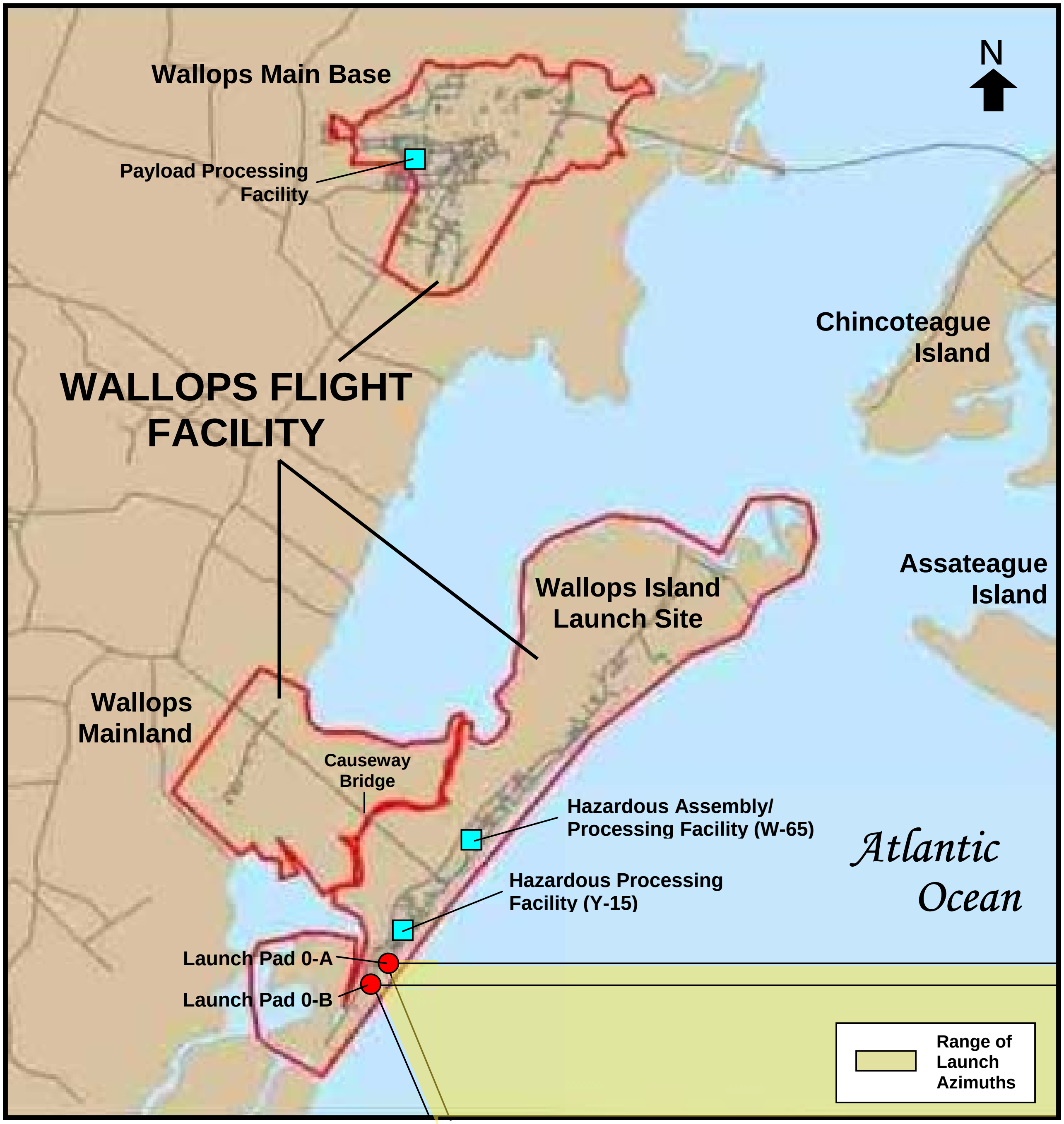


Figure 2-10. Facilities Proposed to Support the OSP at Wallops Flight Facility, Virginia

2.1.4.4.1 Site Modifications

Having recently been upgraded with a new mobile gantry, Launch Pad 0-B would not require any modifications for the OSP.

For Launch Pad 0-A to be used, the facility would require replacement of the existing launch stool, and refurbishment of the multi-level vertical service tower (gantry). The rail rollers on the mobile gantry may also need to be replaced. All facility modifications would occur on the existing concrete pad.

NASA's new Payload Processing Facility (PPF), located in the old Coast Guard housing area at Wallops Flight Facility (Figure 2-10), will eventually include two cleanroom bays: a larger bay with a 40-ton (36-metric ton) crane and a smaller bay with two 20-ton (18-metric ton) cranes. The combination of the cleanroom capability and tall hook heights will allow for the integration of sensitive payloads onto modern launch vehicles. Once completed, the OSP could utilize this facility for payload processing. The construction of the PPF was previously analyzed in the *Final Environmental Assessment for a Payload Processing Facility, National Aeronautics and Space Administration Goddard Space Flight Center, Wallops Flight Facility, Wallops Island, Virginia* (NASA, 2003a).

2.1.4.4.2 Rocket Motor Transportation

Just as described earlier for Vandenberg AFB, the first two or three stages of a MM-derived launch vehicle could be shipped from Hill AFB to Wallops Flight Facility over public roads in an MT trailer. Because of the longer travel distance to Wallops Flight Facility, an alternative would be to ship the booster to the Virginia coast in either an MT or TE trailer by rail. Smaller commercial motors for the upper stages would be either trucked or flown directly to Wallops Flight Facility, which has a runway accessible to C-141, C-17, and C-5 aircraft.

The PK motors would be shipped from Hill AFB to Wallops Flight Facility by rail whenever possible. If the motors were to be shipped by truck, a multi-axle heavy haul commercial trailer would likely be used, especially for the PK 1st-stage motor (SR-118). A Type II semi-trailer and tractor could also be used for the smaller and lighter weight PK 2nd- and 3rd-stage motors (SR-119 and SR-120, respectively). Travel would be mostly over interstate highways and would take approximately 8 to 9 days.

When shipped by rail from Hill AFB, the loaded MT or TE trailer, or individual PK motors, would be taken to a point north of Wallops Flight Facility. Because no railhead goes to the NASA facility, a transfer facility would have to be constructed several miles north of Wallops Flight Facility along an existing rail siding. This would entail construction of an off-load ramp/transfer facility at a remote location with adequate clearance from inhabited structures for satisfying applicable explosive safety requirements. The Eastern Shore Railroad, an independent line, would most likely service this facility if built. Because specific plans for the transfer facility are not yet available, construction of the facility is not analyzed further in this EA. Additional environmental analyses would be conducted, as necessary, prior to its construction.

Once delivered to the new rail transfer facility, the loaded MT or TE trailer would be rolled off the rail car and trucked south to Wallops Flight Facility. To off-load the PK 1st-stage motor, two mobile cranes would lift it from the rail car to a multi-axle heavy haul commercial trailer. Use of a commercial hauler is necessary so as not to exceed the Causeway Bridge weight limitations going from NASA's Mainland property to the Wallops Island Launch Site (Figure 2-10). Because the PK 2nd- and 3rd-stage motors are smaller and present fewer concerns over bridge-weight limitations, they can be off-loaded to a Type II transporter or commercial hauler for travel to the launch site.

For PK rocket motor travel on the local roads leading up to Wallops Flight Facility, vehicles and personnel would control traffic through narrow or curved areas where there is not enough room for two vehicles to pass. Personnel would also warn motorists of the oncoming vehicle or convoy, and transmit to the vehicle or convoy any forward anomalies. These movements would be coordinated with local police authorities.

Just as described earlier for Vandenberg AFB, the transportation, handling, and storage requirements for rocket motors and related ordnance would be accomplished in accordance with DOD, USAF, US DOT, and applicable NASA policies and regulations to safeguard the materials from fire or other mishap. This would include obtaining any necessary oversize/overweight hauling permits from each state where transportation would occur. A detailed transportation plan for moving MM rocket motors has been prepared (TRW, 2002). A similar plan for the shipping and handling of PK rocket motors to Wallops Flight Facility would also be developed prior to any missions at the facility that would utilize PK-derived launch vehicles.

2.1.4.4.3 Pre-Flight Preparations

Upon arrival at Wallops Flight Facility, the rocket motors would be transported to the Hazardous Assembly/Processing Facility (W-65) at the Wallops Island Launch Site. This facility has six bays used to store, stage, and process the rocket motors before they are moved to one of the two launch pads (0-A and 0-B).

Spacecraft and target payloads would arrive at Wallops Flight Facility via truck or military aircraft. Once unloaded, they would be placed in either the Hazardous Processing Facility (Y-15) on Wallops Island, or in the future Payload Processing Facility on the Main Base. If liquid fueling of the payload or HAPS (if used) were required, this operation would be conducted at Y-15. From either building, the payload would then be transported to W-65 for integration with the launch vehicle upper stack (MM-derived vehicles) or for payload assembly (PK-derived vehicles).

The lower and upper stack/payload assembly of a MM-derived launch vehicle would be off-loaded from a TE by mobile crane and placed on the launch stand in a similar manner as described for SSI operations at Vandenberg AFB in Section 2.1.4.1. Motor stages and the payload assembly for PK-derived launch vehicles would also be individually stacked on the launch stand, just like at Vandenberg.

2.1.4.4.4 Flight Activities

When a rocket launch is planned, the booster drop zones and debris impact areas are pre-determined by the Range Safety Office using the same methods used at Vandenberg AFB (Section 2.1.4.1). Wallops Flight Facility would coordinate its operations with the FAA, US Navy, and US Coast Guard to clear potential hazard areas. All potential impact zones within the operating areas would require clearance from the Fleet Area Control and Surveillance Facility prior to launch. This would include operating areas over the ocean, which would be surveyed for ships. Clearance with the FAA would be required for any aircraft hazard that extends beyond the operating areas. NOTAMs and NOTMARs would be issued at least 24 hours prior to launch.

A flight destruct package is required in every launch vehicle. A premature flight termination could become necessary if the vehicle guidance and control system were to malfunction, and the vehicle strayed out of its planned trajectory. Wallops Flight Facility is responsible for flight safety until all flight components have reached impact or have achieved orbital insertion.

2.1.4.4.5 Post-Launch Operations

After each launch, the pad and surrounding area would be inspected and any damage repaired to ready the facility for the next launch, just as described earlier for Vandenberg AFB.

Again, the expended rocket motors and other vehicle hardware would not be recovered from the ocean following flight.

2.1.5 FLIGHT SCENARIOS

At each of the four ranges proposed for OSP operations, clearance areas would be defined by the Range Safety Office to encompass the maximum probable distribution of debris or impact points of rocket components. Figure 2-11 depicts the typical launch and flight clearance areas. Prior to launch, all non-essential personnel would be evacuated from the Launch Hazard Area. Along the flight corridor, every practical effort would be made to keep nonparticipating aircraft and ships clear of the Safety Exclusion Zone. Though an unlikely occurrence, falling debris resulting from an in-flight malfunction or termination would impact within the Debris Limit Corridor.

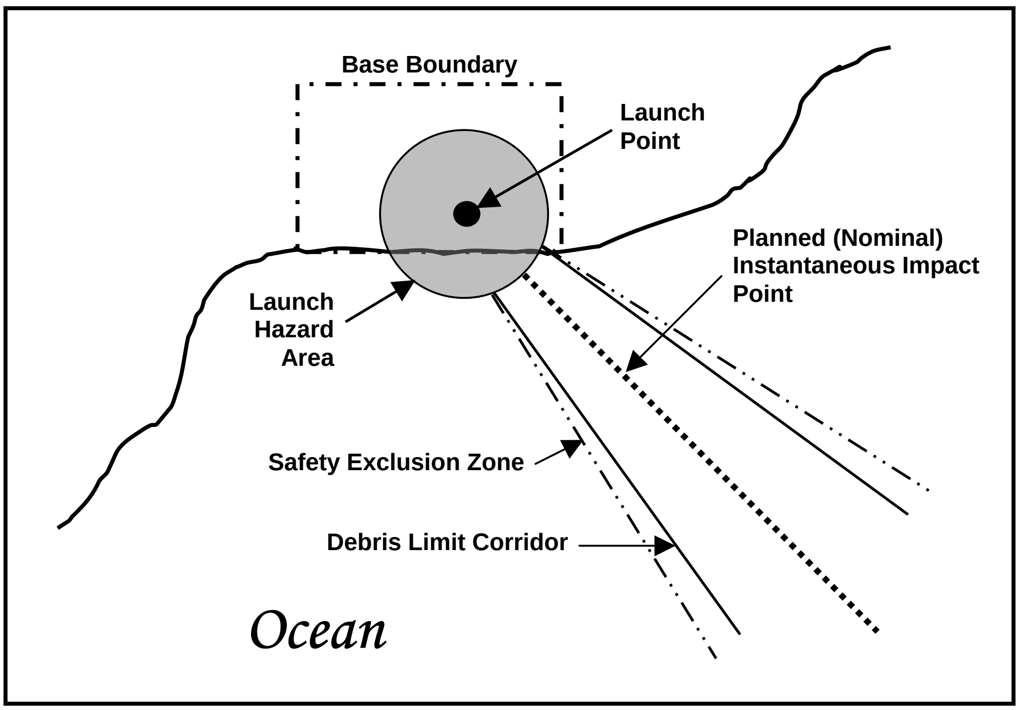


Figure 2-11. Representative Launch and Flight Clearance Areas

Although each of the ranges has numerous flight trajectory options, all or most of the expended rocket motors, sub-orbital payloads, payload shrouds, and other debris from future missions would be expected to fall within broad ocean areas following launch. No inhabited land areas would be subject to unacceptable risks of falling debris.

For launches from either the East or the West Coast, spent 1st-stage motors would typically splash down approximately 70 to 315 nmi (130 to 583 km) off the coast of the launch site. Following in sequence, the spent 2nd-stage motor—and in most cases, 3rd- and 4th-stage motors; and sub-orbital payloads (if used)—would splash down in the ocean hundreds or thousands of miles downrange. Should a land area be deliberately targeted for impact as part of a mission, additional environmental analyses separate from this EA would be conducted, as necessary.

For orbital missions, the upper-stage motors used for spacecraft orbit injection (including the HAPS, if used) could climb into space and remain in orbit following burnout, until they eventually re-enter the atmosphere sometimes days, months, or years later. Should any portions of these stages survive atmospheric reentry, the components would likely impact in the ocean, though there is a small risk for land impacts to occur.

Figures 2-12 to 2-14 show some representative rocket flight paths, booster drop zones, and terminal impact points. Shown are the planned launch of the NFIRE mission from Wallops Flight Facility, an earlier Minotaur I launch of the Joint Air Force Academy Weber State University Satellite (JAWSAT) mission from Vandenberg AFB, and a MM sub-orbital launch from Vandenberg AFB. Flight paths for other missions and from other East or West Coast launch sites would be comparable.

2.2 ALTERNATIVE ACTIONS

2.2.1 ALTERNATIVES TO THE PROPOSED ACTION

Depending on mission needs over the next 10 years, the RSLP could still meet OSP objectives through a lower level-of-activity than that described in Section 2.1 for the Proposed Action. A lower intensity of activities at one or more locations, in some cases, may also provide a meaningful reduction in potential impacts when compared to the Proposed Action. Such alternatives (modifications) to the Proposed Action could come in the form of one or more of the following:

- **Fewer Range Facilities –** Under this scenario, some launch pads or launch support facilities proposed for use at a particular range (where multiple sites are available) might not be used in support of OSP missions, because of logistical or environmental issues, mission conflicts, and/or other constraints.

- **Fewer Number of Launches –** At one or more ranges, fewer than the maximum five to six launches per year may still prove acceptable in meeting OSP mission needs. Though it is very unlikely that five or six OSP launches a year might occur at one range, the allowed maximum number of launches could be specified at a lower rate to ensure that certain levels of activities or impacts at a particular range are not exceeded over the life of the program.

- **Fewer Launch Vehicle Configurations –** The Proposed Action includes use of both MM- and PK-derived launch vehicles. Because of differing characteristics between these two launch vehicles (e.g., launch emissions, launch noise, facility construction requirements, and transportation logistics), it is possible that one of them could be excluded from use at a particular range or launch pad.

Though not analyzed separately in this EA, each of these forms of alternatives would pose less of a risk to the environment than the Proposed Action. The alternatives will be taken into consideration in determining how the Proposed Action, if selected, should be implemented in order to meet current and future mission needs.

2.2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, the OSP would not be implemented. However, existing missions involving the use of excess ICBM assets for target launches out of Vandenberg AFB and Kodiak Launch Complex could still be conducted, in accordance with prior NEPA analyses. In addition, use of ICBM assets for orbital launch purposes would still be considered on a case-by-case basis, with appropriate NEPA reviews.

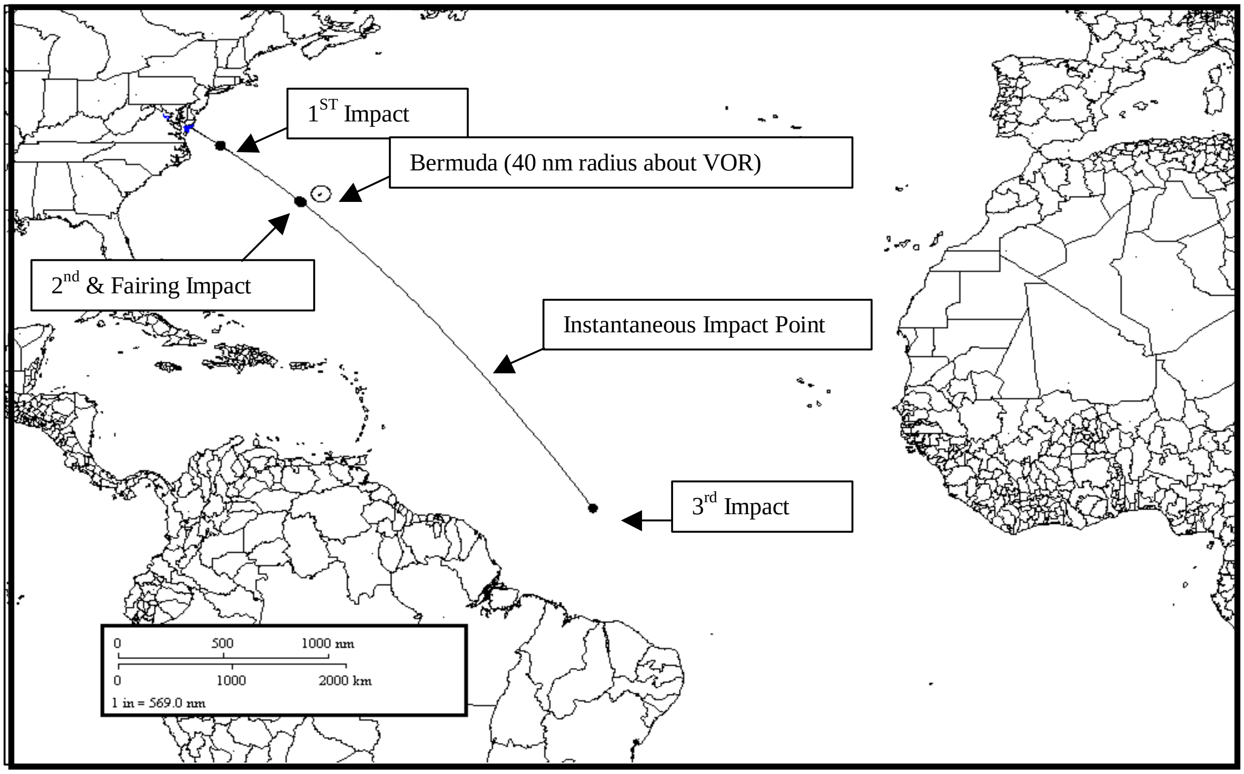


Figure 2-12. Minotaur I/II (NFIRE Mission) Flight Path from Wallops Flight Facility, Virginia

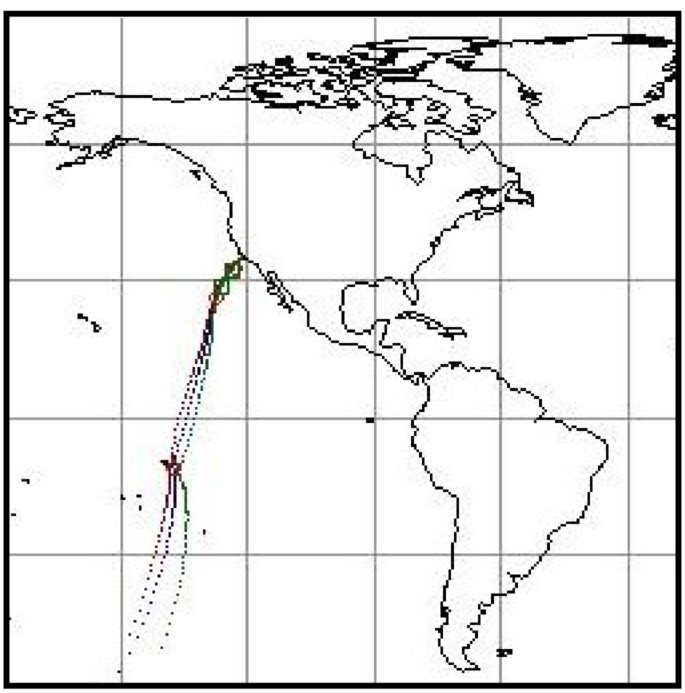


Figure 2-13. Minotaur I (JAWSAT Mission) Flight Paths from Vandenberg AFB, California

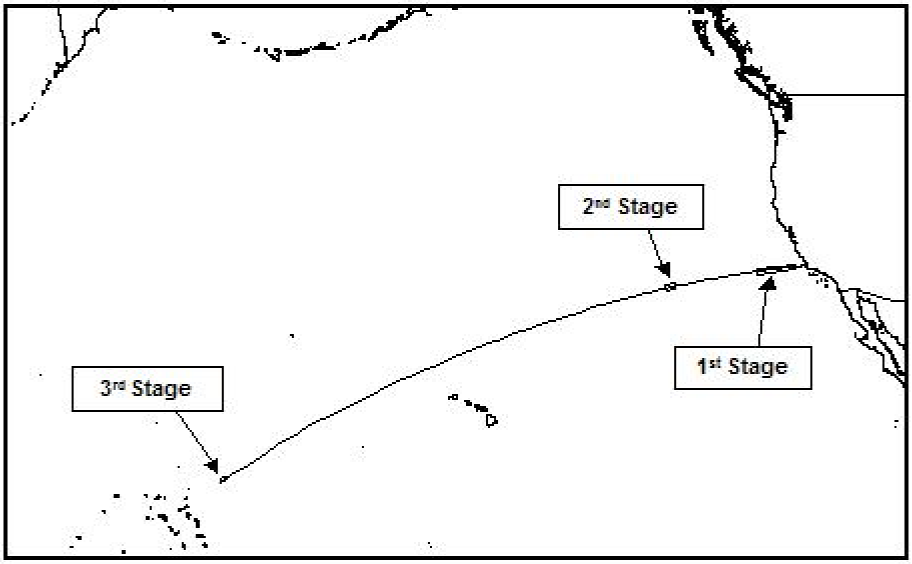


Figure 2-14. Minuteman (Sub-Orbital Mission) Flight Path from Vandenberg AFB, California

By not implementing the Proposed Action, the USAF would not be able to achieve its goal of utilizing MM and PK assets to provide a low cost and proven launch capability to deliver single and multiple payloads into orbit or to support other sub-orbital missions. Government agencies may be forced to continue utilizing other commercial launch vehicles, or larger vehicles, at a higher cost and with greater chance for mission delays. Because of these drawbacks, some RDT&E satellite programs may not be possible.

Should surplus MM and PK motors not be needed for launch purposes, they would likely be subject to disposal. Prior to taking such actions, additional NEPA analyses separate from this EA would be prepared in accordance with CEQ (2002) and USAF (2001a) regulations.

2.2.3 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

Expendable launch vehicles discard boosters and other parts during flight. Because of the inherent dangers associated with these vehicles, each of the four ranges proposed for OSP operations is located either on the East or the West Coast. For this reason, other possible US launch sites, such as White Sands Missile Range in New Mexico, were eliminated from consideration because of their inland location. The Pacific Missile Range Facility, Hawaii, and the Ronald Reagan Ballistic Missile Defense Test Site in the Marshall Islands were also considered unreasonable because of excessive costs of transportation, insufficient infrastructure to support PK-derived launch vehicles, and other logistical concerns.

As described in Section 2.1.4, the USAF applied various evaluation criteria to identify potential launch sites and launch support facilities. In applying these criteria at Vandenberg AFB, the 576-E launch site, located near Purisma Point, was considered for OSP missions, but was deemed unreasonable because of technological issues. Space launches from 576-E would require OSP launch vehicles to make an abrupt turn or dogleg during flight, which would significantly reduce payload lift capability.

Also at Vandenberg, LF-05 on North Base was considered for PK-derived target launches, but was found to be unreasonable because of excessive logistical support requirements and associated costs. Conducting PK launches from the existing silo would require maintenance of the current "cold launch" system for just the one site.[4]

Though computer simulations, modeling, and other laboratory tests are typically used during the design and early evaluation of orbital and sub-orbital missions, such methods cannot provide all of the information needed to satisfy mission requirements (e.g., verify missile defense system performance). Thus, an alternative relying solely on such methods was deemed unreasonable.

2.3 COMPARISON OF ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND NO ACTION ALTERNATIVE

Table 2-8 presents a comparison of the potential environmental consequences of the Proposed Action and the No Action Alternative for those locations and resources affected. Only those resource areas subject to potential impact are addressed (see Chapter 3.0 for a rationale of resources analyzed). A detailed discussion of the potential impacts is presented in Chapter 4.0 of this EA.

2.4 IDENTIFICATION OF THE PREFERRED ACTION

The USAF's preferred action is to implement the Proposed Action at all four ranges—Vandenberg AFB, Kodiak Launch Complex, Cape Canaveral AFS, and Wallops Flight Facility—as described in Section 2.1 of this EA. Selection of specific launch pads at Vandenberg AFB for OSP missions will be determined following public and agency review of the Draft EA, and initial agency consultations. Regarding Cape Canaveral AFS, the selection of a launch pad and other support facilities for OSP use will be determined at a later date, once OSP mission needs and facility availability have been determined. At Wallops Flight Facility, the 0-B launch pad is preferred. Depending on OSP mission needs and launch schedules, more than one launch pad could be selected at each of the ranges, except for Kodiak Launch Complex, where only Pad 1 would be used for OSP launch operations.

[4] The PK was the first (and only) US "cold launched" ICBM. Instead of igniting the main engine immediately in the silo for liftoff, a thermochemical gas generator creates pressure to eject the missile from its launch tube. The main engine ignites after the missile has cleared well above the launch tube.

Table 2-8. Comparison of Potential Environmental Consequences		
Locations and Resources Affected	**Proposed Action**	**No Action Alternative**
Vandenberg Air Force Base, CA		
Air Quality	Proposed demolition and construction activities at some of the launch sites would generate fugitive dust from structure removal, ground disturbance, and related operations. Although no significant amounts of emissions are anticipated, standard dust reduction measures would be implemented. Although rocket motor exhaust emissions would be released in the lower atmosphere, they would be rapidly diluted and dispersed by prevailing winds. As a result, no violation of air quality standards or health-based standards for non-criteria pollutants is anticipated. A review of the Clean Air Act (CAA) General Conformity Rule resulted in a finding of presumed conformity with the State Implementation Plan. As a result, no long-term adverse impacts are anticipated.	Although construction-related impacts associated with the Proposed Action would not occur, demolition-related impacts at Atlas and Titan Heritage program buildings and facilities could still occur. Individual projects, however, would be spread over years, short term at each building location, and standard dust reduction measures would be implemented. Short-term, launch-related impacts—similar to that of the Proposed Action—would still occur, but not as often since fewer launches would be anticipated. In addition, launch-related impacts would only occur at currently active launch.
Noise	Noise exposures from proposed demolition, modification, and construction activities on base are expected to be minimal and short term. The use of heavy construction equipment, power tools, and other machinery would generate noise levels ranging from 50 to 95 dB (unweighted) at 164 ft (50 m). If blasting of concrete structures becomes necessary during the demolition work, much higher impulse noise levels would also be generated. Such occurrences, however, would be rare. OSP launches would generate noise levels exceeding 120 dB A-weighted Sound Exposure Level (ASEL) in the immediate vicinity of the launch site, to approximately 95 dB ASEL or lower in some of the local communities. While these noise exposure levels can be characterized as very loud, they would occur infrequently, are very short in duration (about 20 seconds of intense sound per launch), and would have little effect on the Community Noise Equivalent Level off base. Launches from the SSI CLF and from either of the SLC-4 pads could generate sonic booms over the northern Channel Islands, depending on the launch trajectory used. Resulting overpressures from SSI CLF launches could reach up to 1 pound per square foot (psf) or 80 dB ASEL on the islands. For launches from the SLC-4 sites, overpressures would be higher, estimated to be between 1 and 7 psf. The sonic booms would typically be audible for only a few milliseconds, and launches over the islands are expected to occur infrequently. As a result, no significant impacts to the noise environment on and around the base would occur.	Although construction-related impacts associated with the Proposed Action would not occur, demolition-related impacts at Atlas and Titan Heritage program buildings and facilities could still occur. Individual projects, however, would be spread over years and would be short term at each building location. Short-term, launch-related impacts—similar to that of the Proposed Action—would still occur, but not as often since fewer launches would be anticipated. In addition, launch-related impacts would only occur at currently active launch sites.

Table 2-8. Comparison of Potential Environmental Consequences		
Locations and Resources Affected	**Proposed Action**	**No Action Alternative**
Biological Resources	Demolition and construction-related activities would generate short periods of relatively continuous noise. In rare instances, blasting of existing structures may occur, producing very brief, but high impulse noises. Noise exposures, however, would be short term and localized. Vegetation overgrowth around some unused launch sites would require clearing, and some grading and excavation would occur, mostly in pre-disturbed areas. However, limited areas would be disturbed, and vegetated areas would be surveyed for protected and other sensitive species prior to project implementation. Some of the buildings and structures proposed for demolition and/or modification are currently used as nesting and roosting sites for various bird species, including some protected under the Migratory Bird Treaty Act. A few bat species have also been found to roost in some of the buildings. To avoid impacts to these species, surveys would be conducted several months prior to project implementation, before start of the nesting season. Methods to discourage roosting and the initiation of nests would be implemented prior to demolition and facility modifications. Exposure to short-term noise from launches and helicopter overflights could cause startle effects in protected marine mammals and bird species. However, studies have shown that it is unlikely for the launch noise exposures documented to date to present a serious risk to pinniped hearing. On the basis of prior monitoring studies, it has been determined that rocket launches and helicopter overflights have a negligible impact on marine mammal populations, most sea and shore birds, and other wildlife at Vandenberg AFB. The exception has been the Federally endangered California least tern, which nests and forages at a few beaches and coastal dunes. During some prior Delta II launches at the base, a few pairs of least terns had abandoned their nests. However, OSP launches would differ from the Delta II launches in that (1) the OSP launch sites are located much further away from least tern nesting habitat, (2) there would be no OSP launch vehicle overflights of the least tern colony at Purisima Point, (3) the proposed OSP launch vehicles would generate slightly lower noise levels and for a shorter duration, and (4) no more than two OSP launches per year would occur from those launch sites closest to nesting areas. To minimize the potential for impacts on least terns, the OSP would avoid night and low-light launches, to the extent possible, from the closest launch sites. Sonic booms over the northern Channel Islands could also disturb pinnipeds, and sea and shore birds, that breed, forage, and/or rest at San Miguel and Santa Rosa Islands. However, considering the low acoustical strength of sonic booms expected from OSP launches, and the infrequency of such occurrences, no long-term effects on pinniped hearing would occur. Birds on the islands may exhibit brief flight responses, but they would not be expected to abandon nests. Launch emissions on base have the potential to acidify nearby surface waters. However, surface water monitoring conducted for larger launch systems has not shown long-term acidification of surface waters. Because the OSP launch vehicles, being smaller, produce fewer emissions, the potential for adverse effects is minimal. In addition, the constant deposition of wind blown sea salt would reduce the	Although construction-related impacts associated with the Proposed Action would not occur, demolition-related impacts at Atlas and Titan Heritage program buildings and facilities could still occur. Similar methods to minimize potential impacts on protected and other sensitive species would be implemented. Short-term, launch-related impacts—similar to that of the Proposed Action—would still occur, but not as often since fewer launches would be anticipated. In addition, launch-related impacts would only occur at currently active launch sites.

Table 2-8. Comparison of Potential Environmental Consequences		
Locations and Resources Affected	**Proposed Action**	**No Action Alternative**
	acidification of surface waters. Some temporary distress to nearby vegetation from launch emissions can be expected, but no long-term adverse effects would occur. The probability for an aborted launch to occur is extremely low. If an early abort were to occur, base actions would immediately be taken for the recovery and cleanup of unburned liquid or solid propellants, and any other hazardous materials that had fallen on the beach or in shallow waters. Any propellants remaining in the offshore waters would be subject to constant wave action and currents. Thus, water circulation would, in particular, help to prevent localized build-up of perchlorate concentrations from solid propellants, which has proven to be a slow process. Through coordination and consultations with the USFWS and the NOAA Fisheries Service, the USAF has implemented various plans and measures to limit the extent and frequency of potential impacts from launches and helicopter overflights on protected and sensitive species. In addition, monitoring of certain species during launches is conducted on a regular basis to ensure that no long-term impacts occur. As a result, no significant impacts on biological resources are anticipated, and no long-term adverse effects on threatened and endangered species or critical habitats are expected to occur.	
Cultural Resources	Several known archaeological sites are in proximity to some of the facilities proposed for demolition, modification, and construction. However, these activities would be tailored to ensure archaeological resources are avoided. Should ground disturbance activities occur near resource sites, precautionary measures (e.g., boundary testing, on-site monitoring, and fencing around resource sites) would be implemented. Base personnel and contractors would also be informed of the sensitivity of such sites. To reduce the potential for impacts, excavation and trenching operations would be limited to previously disturbed areas as much as possible. In areas where an overgrowth of vegetation must be cleared and maintained, less disturbing methods and equipment would be used (e.g., use of mowers instead of disc harrows) in order to minimize potential impacts to archaeological sites. Four facilities proposed for OSP use have been determined to be eligible for listing on the National Register of Historic Places (NRHP) for their Cold War, ICBM Program historic context. Modifications are proposed for only one of the buildings; however, a Historic American Engineering Record (HAER) of the building has already been completed. In addition, the types of activities proposed to occur in these buildings would be similar to that of the earlier MM and PK ICBM support programs. Within the ABRES-A launch complex, Building 1788 is potentially eligible for listing on the NRHP. If selected to support OSP launches, modification and use of Building 1788 would require consultation with the California SHPO, and any mitigation measures negotiated with the SHPO for such use would have to	Potential impacts to cultural resources from facility modifications and construction would not occur. However, proposed demolitions at various Atlas and Titan Heritage program buildings and facilities would still take place. Just as for the Proposed Action, precautionary actions would be implemented to avoid potential impacts to archaeological sites. None of the facilities eligible or potentially eligible for listing on the NRHP would be modified or otherwise affected. Because of fewer launches, the potential for launch-related impacts would be slightly less. In addition, launch-related impacts would only

Table 2-8. Comparison of Potential Environmental Consequences		
Locations and Resources Affected	**Proposed Action**	**No Action Alternative**
	be adhered to. No impacts to archaeological sites or historic buildings are expected from nominal flight activities. However, falling debris from a flight termination or other launch anomaly could strike surface or subsurface archaeological deposits, or other cultural resources. With the potential for fires to occur, firefighting activities can also damage subsurface historic and prehistoric archaeological sites. In the unlikely event that a mishap occurs, post-mishap recommendations would include post-event surveying, mapping, photography, and site recordation to determine and record the extent of the damage. These efforts would be coordinated with applicable range representatives and the SHPO to develop the most appropriate mitigation measures based on the nature of the mishap and the cultural resources involved. As a result, no significant impacts to cultural resources are expected.	occur at currently active launch sites.
Health and Safety	Health and safety policies and procedures at the base are well developed and constantly in use. All rocket launches and other hazardous operations are closely reviewed and analyzed to ensure that there are no unacceptable risks to the public, Government personnel, and contractors. For debris generated during each OSP launch (from liftoff through to orbit insertion), expected casualty risks for individuals on the ground would be no greater than 1 in 1,000,000, in accordance with range safety standards. Regarding rocket motor transportation over public roads, accident rates for ongoing operations have historically been very low. As a result, no significant impacts to public or occupational health and safety are anticipated.	Because of fewer launches, the potential for launch-related impacts would be slightly less.
Hazardous Materials and Waste Management	Modifications and relate demolition activities to some buildings and facilities might require surveys for asbestos, lead-based paint, and PCB ballasts if such information is not already available. Any removal of hazardous materials from the buildings and facilities would require containerizing and proper disposal at the Base Landfill or at other permitted facilities located off base. Site modifications proposed for the SLC-4 launch pads and the ABRES complexes would avoid any damage or interference with existing Installation Restoration Program (IRP) treatment and monitoring systems. The cumulative generation of solid waste from OSP-related demolition and construction activities, in addition to other planned demolitions, has the potential to exceed the permitted disposal tonnage on base. Coordination of implementation schedules for these projects, and appropriate tracking of disposal tonnages, would be needed to ensure that permitted disposal amounts at the Base Landfill are not exceeded. All hazardous materials would be managed in accordance with well-established policies and procedures. Hazardous wastes would be properly disposed of, in accordance with all Federal, state, local, DOD, and USAF regulations. The base has a plan in place that provides guidelines and instructions to prevent and control accidental spills of hazardous materials. Appropriate permits are also in place and workers are trained. Hazardous material and hazardous waste handling capacities would not be exceeded, and	The demolition of multiple Atlas and Titan Heritage program buildings and facilities would still occur. The issues and impacts of removing and disposing of hazardous materials from the structures, and tracking disposal tonnages going to the Base Landfill, would essentially be the same as for the Proposed Action. Because of fewer launches, the potential for launch-related impacts would be slightly less.

Table 2-8. Comparison of Potential Environmental Consequences		
Locations and Resources Affected	**Proposed Action**	**No Action Alternative**
	management programs would not have to change. Consequently, no adverse impacts from the management of hazardous materials and waste are expected.	
Kodiak Launch Complex, AK		
Air Quality	Although rocket motor exhaust emissions would be released in the lower atmosphere, they would be rapidly diluted and dispersed by prevailing winds. No violation of air quality standards or health-based standards for non-criteria pollutants is anticipated. Because Kodiak Island Borough is in full attainment with air quality standards, no CAA Conformity Determination is required. OSP activities would not jeopardize the attainment status for the region. As a result, no long-term adverse impacts are anticipated.	Short-term, launch-related impacts—similar to that of the Proposed Action—would still occur, but not as often since fewer launches would be anticipated.
Noise	OSP launches would generate a noise level exceeding 120 dB ASEL in the immediate vicinity of the launch site. Outside the complex boundaries, one ranch and the Pasagshak State Recreation Area could experience launch noise levels up to 95 dB ASEL. While these noise exposure levels can be characterized as very loud, they would occur infrequently, are very short in duration (about 20 seconds of intense sound per launch), and, for public areas, would be well within the OSHA standard of 115 dBA over 15 minutes for permissible noise exposures. Sonic booms produced by launch vehicles would occur well off the coast over ocean waters, and so are not an issue affecting coastal land areas. As a result, no significant impacts to the noise environment on and around the complex would occur.	*(Same as described above)*
Biological Resources	Exposure to short-term noise from launches could cause startle effects in protected bird species and sea otters at Narrow Cape, and pinnipeds on Ugak Island. However, biological monitoring conducted in the area and at other ranges during launches has shown little or no interruption of animal activities, nor any evidence of abnormal behavior or injury. Launch emissions have the potential to acidify nearby surface waters. However, stream testing in the area following launches has not shown any decrease in pH levels. The constant deposition of windblown sea salt in the area helps to reduce the potential for surface water acidification. As a result, no acidification of surface waters would be expected. Some temporary distress to nearby vegetation from launch emissions can be expected, but no long-term adverse effects would occur. The probability for an aborted launch to occur is extremely low. If an early abort were to occur, actions would immediately be taken for the recovery and cleanup of unburned liquid or solid propellants, and any other hazardous materials that had fallen on the ground or in any of the nearby freshwater streams and wetland areas. Any propellants remaining in the offshore waters would be subject to constant wave action and currents. Thus, water circulation would, in particular, help to prevent localized build-up of perchlorate concentrations from solid propellants, which has proven to be a slow process. Through coordination and consultations with the USFWS and the NOAA Fisheries Service, the AADC has implemented various plans and measures to limit the extent and frequency of potential impacts on protected and sensitive species. In addition, pre- and/or post-launch surveys of certain species are	*(Same as described above)*

Table 2-8. Comparison of Potential Environmental Consequences

Locations and Resources Affected	Proposed Action	No Action Alternative
	conducted for each mission to ensure that no long-term impacts occur. As a result, no significant impacts on biological resources are anticipated, and no long-term adverse effects on threatened and endangered species are expected to occur.	
Health and Safety	Health and safety policies and procedures at the complex are well developed and constantly in use. All rocket launches and other hazardous operations are closely reviewed and analyzed to ensure that there are no unacceptable risks to the public, Government personnel, and contractors. For debris generated during each OSP launch (from liftoff through to orbit insertion), expected casualty risks for individuals on the ground would be no greater than 1 in 1,000,000, in accordance with range safety standards. Regarding rocket motor transportation over public roads, accident rates for ongoing operations have historically been very low. As a result, no significant impacts to public or occupational health and safety are anticipated.	*(Same as described above)*
Hazardous Materials and Waste Management	All hazardous materials would be managed in accordance with well-established policies and procedures. Hazardous wastes would be properly disposed of, in accordance with all Federal, state, and local regulations. The complex has a plan in place that provides guidelines and instructions to prevent and control accidental spills of hazardous materials. Appropriate permits are also in place and workers are trained. Hazardous material and waste handling capacities would not be exceeded, and management programs would not have to change. Consequently, no adverse impacts from the management of hazardous materials and waste are expected.	*(Same as described above)*
Cape Canaveral Air Force Station, FL		
Air Quality	Although rocket motor exhaust emissions would be released in the lower atmosphere, they would be rapidly diluted and dispersed by prevailing winds. No violation of air quality standards or health-based standards for non-criteria pollutants is anticipated. Because Brevard County is in full attainment with air quality standards, no CAA Conformity Determination is required. OSP activities would not jeopardize the attainment status for the region. As a result, no long-term adverse impacts are anticipated.	Short-term, launch-related impacts—similar to that of the Proposed Action—would still occur, but not as often since fewer launches would be anticipated.
Noise	OSP launches would generate noise levels exceeding 120 dB ASEL in the immediate vicinity of the launch site, to about 90 dB ASEL or lower in some of the local communities. While these noise exposure levels can be characterized as very loud, they would occur infrequently, are very short in duration (about 20 seconds of intense sound per launch), and, for public areas, would be well within the OSHA standard of 115 dBA over 15 minutes for permissible noise exposures. Sonic booms produced by launch vehicles would occur well off the coast over ocean waters and so are not an issue affecting coastal land areas. As a result, no significant impacts to the noise environment on and around the station would occur.	*(Same as described above)*
Biological Resources	Exposure to short-term noise from launches could cause startle effects in protected bird species at the station, and potentially affect other threatened and endangered species as well. However, biological	*(Same as described above)*

Table 2-8. Comparison of Potential Environmental Consequences

Locations and Resources Affected	Proposed Action	No Action Alternative
	monitoring conducted in the area and at other ranges during launches has shown little or no interruption of animal activities, or any evidence of abnormal behavior, injury, or mortalities. Launch emissions have the potential to acidify nearby wetland areas. However, the deposition of wind-blown sea salt, in addition to carbonate minerals present in the soil and surface waters, would neutralize the acid from infrequent rocket emissions. As a result, little or no acidification of wetland areas or other surface waters would be expected. Some temporary distress to nearby vegetation from launch emissions can be expected, but no long-term adverse effects would occur. The probability for an aborted launch to occur is extremely low. If an early abort were to occur, actions would immediately be taken for the recovery and cleanup of unburned liquid or solid propellants, and any other hazardous materials that had fallen on the beach or in shallow waters. Any propellants remaining in the offshore waters would be subject to constant wave action and currents. Thus, water circulation would, in particular, help to prevent localized build-up of perchlorate concentrations from solid propellants, which has proven to be a slow process. Through coordination and consultations with the USFWS and the NOAA Fisheries Service, the USAF has implemented various plans and measures to limit the extent and frequency of potential impacts on protected and sensitive species. In addition, monitoring of certain species is conducted on a regular basis to ensure that no long-term impacts occur. As a result, no significant impacts on biological resources are anticipated, and no long-term adverse effects on threatened and endangered species or critical habitats are expected to occur.	
Health and Safety	Health and safety policies and procedures at the station are well developed and constantly in use. All rocket launches and other hazardous operations are closely reviewed and analyzed to ensure that there are no unacceptable risks to the public, Government personnel, and contractors. For debris generated during each OSP launch (from liftoff through to orbit insertion), expected casualty risks for individuals on the ground would be no greater than 1 in 1,000,000, in accordance with range safety standards. Regarding rocket motor transportation over public roads, accident rates for ongoing operations have historically been very low. As a result, no significant impacts to public or occupational health and safety are anticipated.	*(Same as described above)*
Hazardous Materials and Waste Management	Modifications to some of the existing facilities might require lead-based paint, asbestos, and/or polychlorinated biphenyl (PCB) surveys if such information is not already available. Any removal of hazardous materials from the facilities would require containerizing and proper disposal at permitted facilities. Proposed modifications at launch complexes would not disturb existing IRP sites and ongoing	Because facility modifications would not take place, the removal and disposal of hazardous materials from existing facilities would not occur and the materials would continue to be managed in place. Otherwise, impacts

Table 2-8. Comparison of Potential Environmental Consequences		
Locations and Resources Affected	**Proposed Action**	**No Action Alternative**
	monitoring activities. All hazardous materials would be managed in accordance with well-established policies and procedures. Hazardous wastes would be properly disposed of, in accordance with all Federal, state, local, DOD, and USAF regulations. The station has a plan in place that provides guidelines and instructions to prevent and control accidental spills of hazardous materials. Appropriate permits are also in place and workers are trained. Hazardous material and waste handling capacities would not be exceeded, and management programs would not have to change. Consequently, no adverse impacts from the management of hazardous materials and waste are expected.	would be the same as described above.
Wallops Flight Facility, VA		
Air Quality	Although rocket motor exhaust emissions would be released in the lower atmosphere, they would be rapidly diluted and dispersed by prevailing winds. No violation of air quality standards or health-based standards for non-criteria pollutants is anticipated. Because Accomack County is in full attainment with air quality standards, no CAA Conformity Determination is required. OSP activities would not jeopardize the attainment status for the region. As a result, no long-term adverse impacts are anticipated.	Short-term, launch-related impacts—similar to that of the Proposed Action—would still occur, but not as often since fewer launches would be anticipated.
Noise	OSP launches would generate noise levels exceeding 120 dB ASEL in the immediate vicinity of the launch site, to about 100 dB ASEL or lower in some of the local communities. While these noise exposure levels can be characterized as very loud, they would occur infrequently, are very short in duration (about 20 seconds of intense sound per launch), and, for public areas, would be well within the OSHA standard of 115 dBA over 15 minutes for permissible noise exposures. Sonic booms produced by launch vehicles would occur well off the coast over ocean waters, and so are not an issue affecting coastal land areas. As a result, no significant impacts to the noise environment on and around the facility would occur.	*(Same as described above)*
Biological Resources	Exposure to short-term noise from launches could cause startle effects in protected bird species at the facility. However, biological monitoring conducted in the area and at other ranges during launches has showed little or no interruption of animal activities, nor any evidence of abnormal behavior, injury, or mortalities. The continued presence and breeding of sea and shore birds at the facility demonstrates that rocket launches over the years have had little effect on these species. Launch emissions have the potential to acidify nearby tidal marsh wetlands and guts. However, these estuarine waters would have sufficient buffering capacity to neutralize the acid from infrequent rocket emissions. As a result, little or no acidification of wetland areas or other surface waters would be expected. Some temporary distress to nearby vegetation from launch emissions can be expected, but no long-term adverse effects would occur. The probability for an aborted launch to occur is extremely low. If an early abort were to occur, actions	*(Same as described above)*

Table 2-8. Comparison of Potential Environmental Consequences		
Locations and Resources Affected	**Proposed Action**	**No Action Alternative**
	would immediately be taken for the recovery and cleanup of unburned liquid or solid propellants, and any other hazardous materials that had fallen on the beach or in shallow waters. Any propellants remaining in the offshore waters would be subject to constant wave action and currents. Thus, water circulation would, in particular, help to prevent localized build-up of perchlorate concentrations from solid propellants, which has proven to be a slow process. Through coordination and consultations with the USFWS and the NOAA Fisheries Service, NASA has implemented various plans and measures to limit the extent and frequency of potential impacts on protected and sensitive species. In addition, monitoring of certain species is conducted on a regular basis to ensure that no long-term impacts occur. As a result, no significant impacts on biological resources are anticipated, and no long-term adverse effects on threatened and endangered species or critical habitats are expected to occur.	
Health and Safety	Health and safety policies and procedures at the facility are well developed and constantly in use. All rocket launches and other hazardous operations are closely reviewed and analyzed to ensure that there are no unacceptable risks to the public, Government personnel, and contractors. For debris generated during each OSP launch (from liftoff through to orbit insertion), expected casualty risks for individuals on the ground would be no greater than 1 in 1,000,000, in accordance with range safety standards. Regarding rocket motor transportation over public roads, accident rates for ongoing operations have historically been very low. As a result, no significant impacts to public or occupational health and safety are anticipated.	*(Same as described above)*
Hazardous Materials and Waste Management	All hazardous materials would be managed in accordance with well-established policies and procedures. Hazardous wastes would be properly disposed of, in accordance with all Federal, state, local, and NASA regulations. The facility has a plan in place that provides guidelines and instructions to prevent and control accidental spills of hazardous materials. Appropriate permits are also in place and workers are trained. Hazardous material and waste handling capacities would not be exceeded, and management programs would not have to change. Consequently, no adverse impacts from the management of hazardous materials and waste are expected.	*(Same as described above)*
Global Environment		
Upper Atmosphere/ Stratospheric Ozone Layer	When compared to the amount of emissions released on a global scale, the OSP launches would not be statistically significant in contributing to local or cumulative impacts on the stratospheric ozone layer. Emission would be rapidly dispersed during the launch vehicle's ascent.	Impacts similar to that of the Proposed Action would still occur, but not as often since fewer launches would be anticipated.
Broad Ocean Area/ Marine Life	Sonic boom overpressures from launch vehicles could be audible to protected marine species and sea turtles underwater. An underwater acoustic pulse of 178 dB (referenced to 1 μPa) is considered the lower limit for inducing behavioral reactions in marine mammals (cetaceans), while 218 dB (referenced to 1 μPa) is considered the lower limit for inducing temporary threshold shift (TTS) in marine mammals and sea turtles. The sonic booms generated during ascent of OSP launch vehicles are expected to result	Impacts similar to that of the Proposed Action would still occur, but not as often since fewer launches would be anticipated. In addition, impacts are more likely to occur in the Pacific

Table 2-8. Comparison of Potential Environmental Consequences

Locations and Resources Affected	Proposed Action	No Action Alternative
	in underwater pressures less than 140 dB (referenced to 1 μPa). On their descent to the ocean surface at the terminal end of each flight, sub-orbital target payloads will also cause sonic booms, which will generate peak underwater pressures ranging from 117 to 176 dB (referenced to 1 μPa). Thus, the resulting pressures from sonic booms would fall below the lower limits for inducing behavioral reactions, and well below the TTS threshold. For marine animals, the potential exists for direct contact or exposure to underwater shock/sound waves from the splashdown of spent rocket motors and sub-orbital target payloads. However, the likelihood for protected marine mammals or sea turtles to be located in close proximity to the impact points is extremely low. OSP launches would occur only a few times per year, and impacts from each flight likely would not occur at the same locations. Residual amounts of battery electrolytes, hydraulic fluid, and propellant materials in the spent rocket motors could lead to the contamination of seawater. However, the risk of marine life coming in contact with, or ingesting, toxic levels of solutions is not considered significant because of the rapid dilution of any contaminants; and the rapid sinking of any contaminated components to depths that are out of reach for marine mammals, sea turtles, and most other marine life. In summary, OSP launches would have no discernible effect on the ocean's overall physical and chemical properties. There would be minimal risk of launch vehicle components hitting or otherwise harassing marine mammals and sea turtles within the open ocean. Moreover, such activities would have no discernible effect on the biological diversity of either the pelagic or benthic marine environment. Consequently, no threatened and endangered marine mammals or sea turtles are likely to be adversely affected, nor would other biological resources within the open ocean be significantly impacted.	Ocean than the Atlantic because of the launch sites used.
Orbital and Re-entry Debris	The probability that OSP mission spacecraft in LEO would collide with medium- and large-size debris over their functional lifetimes is considered low. Moreover, OSP missions would be conducted and timed to avoid any possible impact or collision with the International Space Station and other manned missions, as part of normal operations. Accordingly, no significant impacts to the orbital debris population are expected. Because casualty risks for re-entry debris from all injection stage motors, and from all or most OSP orbital mission payloads (spacecraft), would be within DOD guidelines (expected casualty risk levels no greater than 1 in 10,000), and that no casualties from re-entry debris have been reported over the last 40 years, no significant impacts from re-entry debris are expected to occur.	Similar impacts to that of the Proposed Action would occur, but to a lesser degree since there would be fewer orbital missions.